MAR 23 1925

The ELECTRICAL REVIEW

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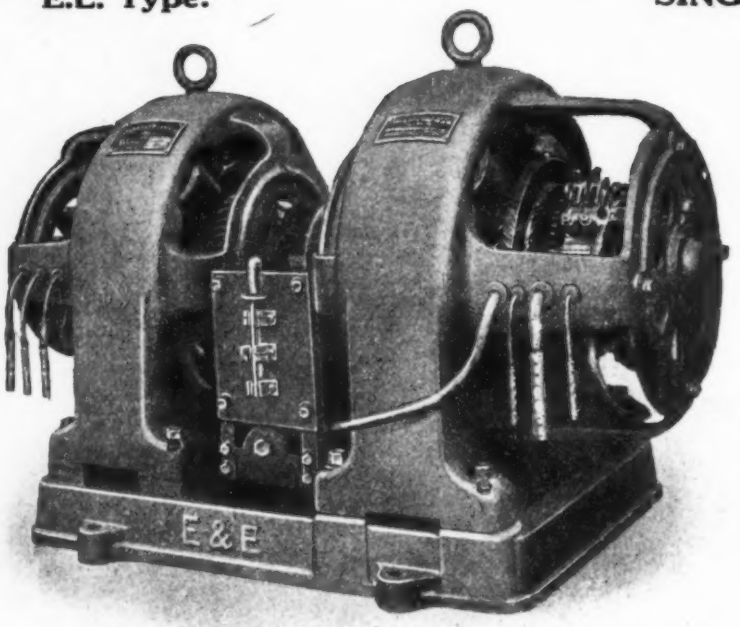

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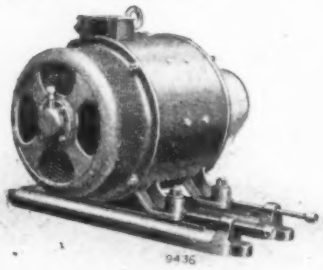

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The

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Electric Power Supply.

NOT only in this country, but also in the United States, the question of the future policy to be pursued with regard to the development of electrical power has come into prominence. As reported in our pages last week, the Governor of Pennsylvania has invited the State Legislature to regulate the business of electricity supply, and holds the view, according to *The Times*, that in the future "transmission companies would be given the status of common carriers and compelled to accept for transmission all current offered them, and to sell current at reasonable rates to all who wished to buy it." He also contemplates the formation of companies to erect large generating stations (of not less than 300,000 kW) in coal areas and to carry on the business of bulk supply. These proposals are somewhat similar to those outlined by Mr. A. Page and Mr. G. V. Twiss, as stated in our pages recently.

In the *English Review* for February there was published an interesting article on the same subject by the Hon. Herbert Hoover, Secretary of Commerce of the United States, who emphasised the importance in the public interest of substituting mechanical for manual labour, and discussed policies of government best suited to secure the maximum development and widest distribution of electric power at least cost to the consumer. Groups of large and efficient generating stations interconnected into single systems covering wide areas are the essence of the policy which he advocates, and he foreshadows an output in the United States of 60,000,000,000 kilowatt-hours in 1925. During the next 30 years Mr. Hoover foresees the expenditure of from 30 to 40 thousand million dollars for new electrical equipment in that country alone. There are in the United States about 6,000 electricity supply undertakings, of which less than 10 per cent. are interconnected, and Mr. Hoover says: "We need interconnection of these isolated systems over large geographical areas so as to provide a sort of great reservoir into which these larger streams of power may

be poured." Besides minimising reserve plant and obtaining the benefits of diversity of load, in the United States great advantage would be derived from the utilisation of the flood water in the wet season, which would nearly double the available water power, the steam plant standing by for use in the low-water season. The decentralisation of industry, of course, would be made possible when the supply was equally available in town and country, and many other salutary results would follow its provision.

At the same time, the matter would become very complicated in respect of finance and administration, and many difficult problems would have to be solved. Competitive supply would be out of the question; hence the principle of monopoly must be accepted, and this would involve that of public regulation, which indeed is already in force in many of the States. Boundary questions as between the several States would have to be swept away, for there must be a free flow of power across State boundaries if the system were to be fully developed, and here Mr. Hoover advocates "constructive co-operation." But he will have nothing to do with those who would entrust to the Federal Government the development of the system, claiming that individual enterprise and equality of opportunity for all are vital to the progress of the nation: "It is the business of Government to provide an open road for the individual initiative of its citizens, not to substitute its own activities for that initiative; to see that free opportunity is given for the economic production of wealth, not to produce wealth itself. . . . It is the business of Government to regulate and control, not to manage or operate." We need not say that with regard to these matters we are wholly in agreement with Mr. Hoover, provided that "to regulate and control" is rightly interpreted and does not involve too much interference.

As for the bearing of his remarks on our own conditions in this country, we must confess that we are far from satisfied that anything in the nature of a "National Busbar System" is desirable. What we think is needed is the coupling of the existing systems of distribution into one or more great networks, fed at numerous points from different sources, like a town supply network fed from numerous sub-stations, but with the difference that the latter would be represented, in the national scheme, by large (not too large) generating stations. In other words, the network itself would be the interconnecting medium. But we must leave the further discussion of this most interesting subject to another occasion.

Electricity v. Gas for New Houses.

In our last issue we published an abstract of a report by the General Purposes Committee of the London County Council, nominally on the question whether gas was or was not any longer essential to the running of a house. The report was somewhat discursive, and the conclusions rather indefinite, but, nevertheless, it was of great interest.

It first dwelt upon the merits of electricity, dismissing electric lighting as occupying the pre-eminent position without question. Its commendations of other electrical operations, while sufficiently warm, were slightly tempered by just criticisms. The electric boiling ring was held to mar the complete ascendancy of the electric cooker, but, as explained, this difficulty could be met by the use of an efficient electric kettle. Otherwise, "electric ovens offer considerable advantage over gas ovens; they are not more costly to use, are reliable, and are capable of producing more consistent results than gas ovens." Water-heating by electricity is recognised as a difficult problem, which, however, may be solved eventually by the 100 per cent. load-factor system combined with the low rate which it permits. The advantages of smaller apparatus are out of all proportion to their small cost of operation, and hiring schemes can surmount the difficulty of initial cost.

So far, the report is all in favour of electricity; it only remains to see how its inestimable advantages are secured by the Council for the tenants of its new houses. In three of the smaller L.C.C. estates arrangements have been made with the local authorities to supply electricity, and at another a bulk supply is being provided by a company. At the Whiston House tenements it has been found cheaper to install electricity for all purposes than to install gas for lighting and cooking. These installations, says the report, are in the nature of an experiment. When the larger estates are considered, however, the position is entirely different, thanks (if that is the word) to the methods of the gas companies. In each case the latter effectually ousted electric lighting by quoting a very low rate for both lighting and cooking (in one case the installations were provided *gratis*), whilst for cooking alone a price was quoted which became unapproachable when combined with the cost of electric lighting alone. The electricity supply authorities produced nothing to counter these tempting offers, and so, again to quote the report, "gas lighting and cooking had to be decided upon for financial reasons."

These estates are all of considerable extent, and they would have proved a very acceptable acquisition not only to the suppliers of the energy, but also to manufacturers and retailers of a huge quantity of electrical appliances. It appears that the electricity suppliers hesitated to cut their terms to a reasonable and competitive figure, looking upon such a procedure as a direct loss instead of a direct investment.

London Traffic.

The remarkable address delivered by Lord Ashfield from the chair at the annual general meeting of the "Underground Group" on February 20th should afford much food for thought for the irresponsible lay Press critics of the London County Council tramways, who recklessly demand the abolition of tramways and the substitution of omnibus services. As we have shown, scrapping the tramways would involve an annual call upon the rates of over a million sterling for many years to come, without providing an alternative source of revenue. But what of the omnibuses? Could a municipal omnibus service be established on a sound financial basis? Lord Ashfield, whose undertakings must be acknowledged to be conducted on most efficient lines, under the best management obtainable, and with practically unlimited capital resources, appears to despair of success with omnibuses even when he has a perfectly free hand to organise the services to the best advantage, and appeals in the last resort to the powers of the Minister of Transport to restrict competition.

Although his companies carried no fewer than 1,457,000,000 passengers last year—a number almost inconceivable, representing an increase of 111,000,000 or 8 per cent. over the previous year—and the whole of this additional traffic was carried by the omnibuses, the increased cost of operating the omnibus services has more than off-set the gain in receipts, and the net result is a reduction of a quarter of a million in the net receipts, compared with the previous year. Yet the omnibuses bore no share of the cost of widening and repairing roads, and contributed nothing to the rates in respect of track. What showing would they have made if these burdens had been imposed upon them as upon the tramways?

Lord Ashfield, remarking on the increasing "habit of travel," said: "It seems, therefore, an extraordinary and inexcusable situation that with all this vast volume of traffic to handle it should not be possible to ensure a reasonable return on the capital invested in the provision of the transport facilities employed." And so it is.

Since the war more than 15 millions sterling has been spent by the Group, which is committed to a further outlay of five millions; but no additonal expenditure can be contemplated until the system as a whole attracts sufficient traffic to be self-supporting. Lord Ashfield's remedy is the restriction of unchecked competition, co-ordination of the various transportation facilities,

common management (but not common ownership), and —"inevitably"—a pool of receipts. And for all these changes he looks to the Advisory Committee of the Ministry of Transport.

This journal has always advocated centralised traffic control for London, and it also looks forward hopefully to the time when the Ministry by well-considered and firm but cautious action shall reduce chaos to order and restore prosperity to the transport services, of which the electric railways and tramways form so large a part. Most of the streets already scheduled by the Minister of Transport as calling for restriction of traffic are those in which there are no tramways. The L.C.C. tramways last year carried 668 million passengers, and provided seating capacity for many more; they were in competition with more than 1,000 omnibuses, one-fifth of the total number plying in London.

The Shannon Scheme.

The report of the Continental experts on the German scheme for developing and utilising the water power of the River Shannon, of which particulars were published towards the end of December, has not escaped criticism at the hands of British engineers. In *Irish Engineering* for January an article was published by Mr. Percy A. Spalding, who pointed out that fair comparisons could not be drawn between Ireland and other small countries such as Switzerland and New Zealand, where the physical conditions were favourable to development at moderate cost and coal was excessively dear. He considered that the Shannon scheme was 20 years before its time, for there was practically no demand for electrical energy outside Dublin and Cork, and no evidence that the demand which was essential to success could be created. In Mr. Spalding's opinion local enterprise, which was being held up by the scheme, should be encouraged to set up small generating stations with oil-driven plant, which could be done very economically and at low capital cost, instead of expending five millions on a scheme which, if financed by the State, would probably necessitate extra taxation. If the Shannon scheme eventually matured, these stations would provide the essential stand-by. At the best, the Shannon supply could not be available to the great majority of provincial towns for years to come.

A much more comprehensive attack upon the scheme is made by Mr. Theodore Stevens in a pamphlet which he issued last month, entitled "The 1924 Shannon Scheme in True Perspective." Mr. Stevens is intimately acquainted with the subject, for in 1915 he himself drew up a scheme for the development of the River Shannon, and again in 1920 he worked out plans for utilising its water power in successive stages, for his report to the Water Power Resources of Ireland Sub-Committee. The contents of the pamphlet consist mainly of quotations from authorities and published records, with maps and statistics, which will be useful for reference, though the style in which they are strung together is, to say the least, staccato.

On two features of the scheme Mr. Stevens lays special stress. He points out that it provides only for the supply of electricity on the outskirts of villages, leaving consumers to do the rest, whereas in New Zealand the State delivers it to the home and farm and provides the motors, so that the farmer incurs no capital outlay; moreover, the author declares that the energy cannot be supplied at the price suggested. Again, he directs attention to the transmission voltages contemplated in the scheme, which in respect of 94 per cent. of the total mileage of mains (2,592) do not exceed 36,500 volts. In view of the long distances to be covered, in many cases exceeding 200 miles, in order to supply energy in all parts of the Free State, Mr. Stevens has no difficulty in showing that in accordance with universal practice the primary pressure would have to be at least 100,000 volts.

With regard to the use of small generating stations, his views are similar to those of Mr. Spalding, and he indicates the necessity of developing the demand before installing the generating plant. His conclusions are that the Liffey should be developed first, at a quarter the cost of the Shannon scheme, and that the former would pay its way from the start.

We cannot but regret that both in this country and in Ireland this great question of electricity supply seems to attract politicians who are on the look-out for a red herring to draw across their devious paths and to divert attention from their own shortcomings. The Irish Government will go its own way, but in our opinion it will incur a very grave and unjustifiable risk if it does not give the most mature consideration to the matter and obtain the most reliable expert advice on its every aspect before committing the State to so speculative and costly an undertaking.

Radio Interference.

The title of this note does not refer to proposals now before Parliament, but to phenomena which are met with in the operation of receiving apparatus, and which are sometimes difficult to explain and to eliminate. In the United States, according to the *Electrical World*, electricity supply companies are up against problems unknown before the advent of broadcasting; it appears that their power lines, which are largely overhead, are the cause of much interference with the reception of concerts and lectures, and that public opinion is becoming restive to a degree that compels the attention of the supply companies to the subject, lest the popularity of their service should be seriously affected. It is stated that there are now more than 30 million listeners in the United States, and the number is rapidly increasing; hence the problem must be regarded as of great importance. It is aggravated by the fact that listeners who suffer from the intrusion of atmospheric disturbances, or from noises arising in their own receiving sets, are apt to put them all down to the power lines, though the latter may happen to be quite innocent. Hence our contemporary urges supply authorities to take immediate steps to propitiate the public by giving assurances of their determination to remove all causes of interference from their systems.

In this country, where underground mains are almost universal and pole transformers are rarely seen, such troubles have not attained, and are not likely to attain, similar dimensions; but nevertheless interference sometimes occurs, as was instanced in a recent article by Mr. W. Redmayne in our pages. The a.c. hum—and sometimes the d.c. hum—met with in houses where electricity is used for purposes other than radio may become a source of great annoyance, and is not easily eliminated by the non-electrical listener. A case within our own experience where the switching-on or off of certain lighting circuits invariably put the crystal set out of action—apparently by inducing an electric impulse through the contact—proved exceedingly vexatious until a slight change in the position of the aerial lead disposed of it. In the same house, on d.c. mains, the hum of the supply current is sometimes unbearable; such a hum may be due to ripples arising either from commutation, armature slots, or harmonics in the a.c. system supplying the sub-stations. It would be interesting to hear of other cases noticed by our readers. We have observed that a.c. hum is far less audible with a cat's-whisker contact than with a perikon detector.

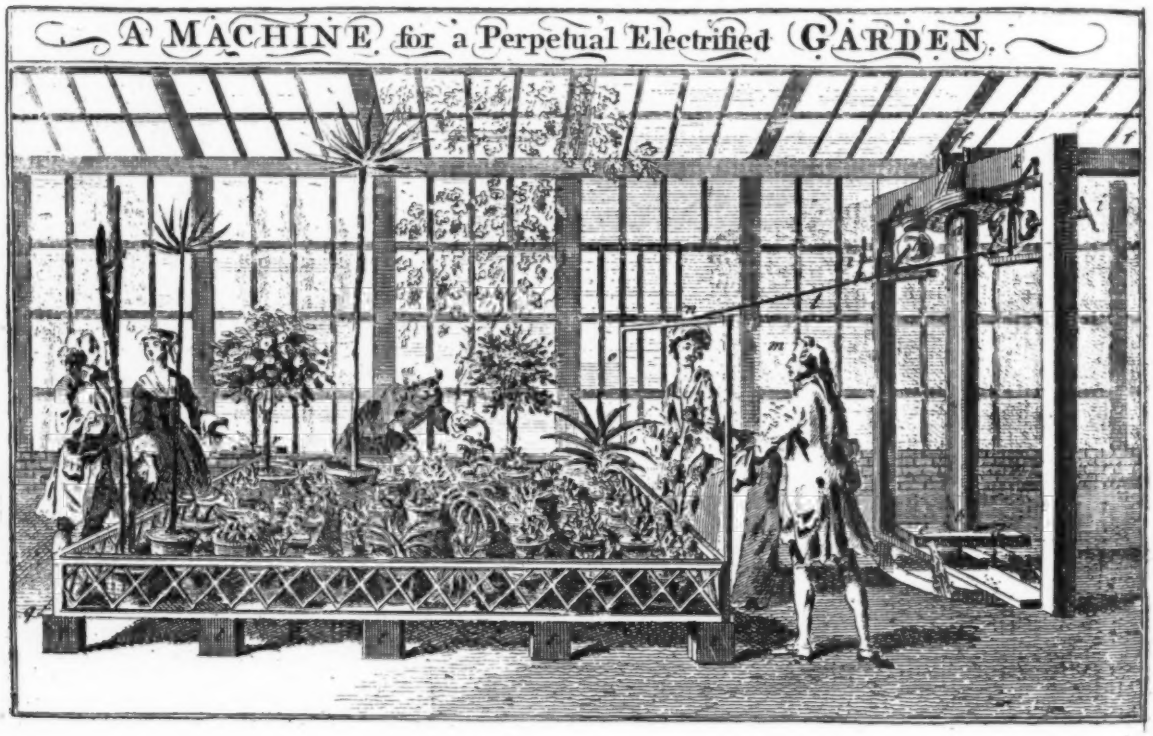
Another rather peculiar cause of interference, reported by a correspondent of the *Electrical World*, is vibration of the contacts of thermostats controlling "heating pads"; these contacts, instead of closing and opening at fairly long intervals, have been known to chatter at the rate of 40 times a second, making radio reception impossible over a radius of about a quarter of a mile! Recently, also, one of our own correspondents recorded the occurrence of an artificial storm—from the radio point of view—due to the ignition coil of his lighting set. These troubles, and of course the racket in the receivers which attends the use of a suction cleaner or other motor-driven device in the vicinity of a receiving set, can be remedied by obvious means.

Electroculture in 1755.

That there were far-sighted electrical amateurs 170 years ago is proved by the accompanying article and woodcut, which were published in the "Monthly Magazine" dated July, 1755. We are indebted for the extract to Mr. C. R. Lee, of Messrs. Crompton & Co., Ltd., Unfortunately the title-page of the publication, which appears to be a philosophical magazine, is missing; the pages measure 8 × 5 inches, and we have before us pp. 109 to 124, with two plates, including the one here reproduced full size. From internal evidence it appears likely that this was the fourth issue. The type is, of course, of a quaint old-fashioned character, and the article reads as follows, the letter "f" being here used to represent the old scroll-form letter "s":—

A Defcription of a Machine for a *perpetual* Electrification.

As it is our profefs'd Defign to improve every Difcovery for the Public Good, as far as we are able; and as *Electricity* is now well known to be fomewhat more than a Matter



of *mere Curiofity*, inafmuch as it has been fuccefsfully applied to the Cure of feveral Diforders of the *rheumatic* and *paralytic* Kind, and to remove Obftructions and Pains occafioned thereby; alfo it is well known greatly to promote *Vegetation* in *Plants*; and doubtlefs might be found of Ufe in many other Cafes, if it were applied in a *proper Manner*, I mean fo that it might be rendered *conftant* or *perpetual*, and not *momentary* and *inftantaneous*, as in the *common Way* of uſing it. For, if fuch furprizing Effects be producible by its fuddain, and, as it were, fingle Action, what may we expect from the continual Action or Influence of fuch a powerful Agent; that is to fay, from a *perpetual Electrification* of *animal and vegetable Bodies?*

In order to affift in fuch an Undertaking, we here propofe a Machine, which we think will be fufficient for an Experiment of this Kind. It is the Application of the *Hydraulic Machine*, invented many Years ago, by Dr. *Barker*; with a proper *Apparatus* for perpetually electrifying the Plants and Fruit Trees of an *artificial Garden*. The Defcription of which is as follows.

a, b, is the upright Tube or Body of the Machine, 8, 10, or 12 Feet in Height.

c, d, the horizontal Trunk, thro' which the Water fpouts from Holes at each End, but on contrary Sides.

e, e. A large open cylindrical Part on the Top of the Machine, to receive the Water from.

f, A Trough, which brings a fmall Stream of Water from fome adjacent Spring, &c., which turns the Machine.

g, b, Two Glafs Globes, turn'd by the Machine by means of a Cord from the Groove in the outer Part of the Receiver *e, e*, and moving in Grooves of leffer Wheels fix'd on the Axles of the Globes.

i, i, Two Screws, by which the Cufhions are prefs'd againft the Globes for greater or leffer Degrees of Friction.

k, k, Two iron Arms fixed in the Frame of the Machine, and projecting beyond the Globes, fufpend, on filken Strings, a long Rod of Iron, in Form of T, whofe Part

l, l, receiving the Electricity from the Globes, conduct it to

m, n, o, A flight Frame of Wood in the Front.

p, q, r, s, The Electrical Garden, placed on

t, t, t, t, &c, fmall Pedeftals, or Pillars of *Wax* and *Rofin*.

In this Garden may be placed in Pots any Sorts of Plants, Flowers, &c., which, when the Machine is in motion, may be conftantly electrify'd. One Globe is enough to be in Motion at a Time; and when that is too hot, the other may be put into Motion; and fo they may be alternatively ufed Night and Day, without Ceffation of the *Electrical Effluvia* on the Plants. As a conftant Stream of Water may in moft Places be had, and as the Expence of fuch a Machine and Garden would not be very great, it is much to be wifh'd, that thofe who have it eafily in their Power, would oblige Mankind with fome Attempt of this Nature, that they might be fatisfied what could be effected in *Medicine* or *Phyfics*, by a *perpetual Electrification*.

N.B. Eight or ten Feet Fall of Water will be more than fufficient for this Purpofe, and the Diameter of the Tube, *a, b*, five or fix Inches at moft.

Electrically-produced Carbon Black.—Electrical means of manufacturing carbon black, a widely used pigment, have been devised by the Bureau of Mines, U.S. Department of the Interior. Carbon black consists of exceedingly finely divided particles of carbon, and is at present produced by burning natural gas with an insufficient air supply, and permitting the flame to impinge on a cool metal surface. This method has been found strongly objectionable in many communities, and stringent ordinances have been passed to regulate its manufacture. Inasmuch as carbon black is in great demand for the manufacture of printer's ink, shoe and stove blackings, phonograph records, black leather, typewriter ribbons, carbon paper and many other articles, a method of manufacture that does away with the objectionable though inevitable uncleanliness of the present process has been much desired. The Bureau of Mines process involves the use of high-voltage discharges from electric arcs acting upon cheap light-oil distillates.

The Design of New Transformers to Operate in Parallel with Existing Transformers.

By S. AUSTEN STIGANT, M.I.E.E., M.Am.I.E., Chartered Electrical Engineer.

FREQUENTLY new transformers are required to operate in parallel with existing transformers which may be of one's own make or may have been built by another manufacturer. It is the exception rather than the rule for the original inquiry to specify those technical particulars of the existing transformer which are required to enable a quotation for the proposed new transformer to be prepared, which would ensure satisfactory parallel operation of the old and new transformers. If the required particulars of the existing transformers are not originally given, a standard design only can be offered, and the performance guarantees must perforce be modified subsequently when full details of the existing transformer become available. In order to design a new transformer to operate satisfactorily in parallel with an existing one, the following technical particulars of the latter must be available :—

1. Continuous output in kVA.
2. Primary and secondary connections.
3. Percentage impedance at continuous output, normal pressure and at a specified temperature.
4. Percentage reactance at continuous output and normal pressure.
5. No load turns ratio per phase at the normal pressure and at all tappings.
*6. In the case of delta/delta and star/star connected transformers it is necessary to know the internal polarities, as otherwise the internal meshing of the phases of the new transformer may have to be altered. The same information is *desirable* with other connections, although even if the polarities of the two transformers are opposite, they may be phased in by a suitable choice of external connections to the busbars.

All the above information can, however, be obtained by one manufacturer from another if the inquiry specifies the machine or serial number.

Two or more transformers will operate satisfactorily in parallel if the following conditions are complied with :—

7. The same inherent phase angle difference between primary and secondary terminals; this corresponds with item 2.
8. The same percentage impedance; this corresponds with item 3.
9. The same pressure ratio; this corresponds with item 5.
10. The same polarity; this corresponds with item 6.
11. The same phase rotation.

It is desirable that the ratio of percentage resistance to percentage reactance pressure drops should be the same in both transformers in order to avoid a phase displacement of the load currents in the transformers with the load currents in the lines. A certain degree of departure from coincidence of this ratio may, however, be allowed without any appreciable effect becoming manifest upon the loading of the transformers.

Items 1, 2 and 7 are generally specified in the original inquiry, and offer no difficulties. Items 6, 10 and 11 can easily be satisfied subsequent to the placing of the order, either by suitable internal meshing of the phases or by a suitable choice of the external connections to the busbars. The only features that sometimes require the exercise of considerable skill on the part of the designer are covered by items 3, 4, 5, 8 and 9.

Parallel operation will be satisfactory if the percentage impedance of the new transformer is within 10 per cent. of its desired theoretical value, and if the pressure ratios are within 0.5 per cent. of their desired values.

Consider first the question of turns ratio. The formula connecting the various design features is—

$$v/T = \frac{B \cdot A \cdot n}{3{\cdot}49 \times 10^8}$$

Where v/T = Volts per turn of both windings.
B = Induction density in lines per sq. cm.
n = Frequency in cycles per second.
A = Core cross section in sq. in.

The requirements of standardisation necessitate fixed core cross sections in more or less close steps, while the frequency is fixed by the customer's supply. The volts per turn, and consequently the turns ratio, are, therefore, controlled by the value of B, which is relatively flexible.

TABLE I.

PRESSURE AND TURNS RATIO OF THREE PHASE 50~ OIL S.C. TRANSFORMERS STAR/STAR CONNECTED & FITTED WITH PLUS & MINUS 2½% & 5% TAPPINGS

NORMAL LINE PRESSURE = 440 VOLTS *

KVA	V/T	AT − 5% TAP PHASE VOLTS = 241		AT − 2½% TAP PHASE VOLTS = 248		AT NORMAL TAP PHASE VOLTS = 254		AT + 2½% TAP PHASE VOLTS = 260		AT + 5% TAP PHASE VOLTS = 267	
		TURNS	ACTUAL VOLTS	TURNS	ACTUAL VOLTS	TURNS	ACTUAL VOLTS	TURNS	ACTUAL VOLTS	TURNS	ACTUAL VOLTS
100	4·6	52	239	54	248	55	253	56	257·5	58	267
250	7·5	32	240	33	247·5	34	255	35	262·5	36	270
500	9·0	27	243	28	252	28	252	29	261	30	270
1000	12·5	19	237·5	20	250	20	250	21	262·5	21	262·5
1500	15	16	240	17	255	17	255	17	255	19	270

* GENERALLY THIS IS A SECONDARY PRESSURE, A SECONDARY TAPPINGS AT THIS PRESSURE ARE UNUSUAL.

NORMAL LINE PRESSURE = 3300 VOLTS.

KVA	V/T	AT − 5% TAP PHASE VOLTS = 1810		AT − 2½% TAP PHASE VOLTS = 1857		AT NORMAL TAP PHASE VOLTS = 1905		AT + 2½% TAP PHASE VOLTS = 1952		AT + 5% TAP PHASE VOLTS = 2000	
		TURNS	ACTUAL VOLTS	TURNS	ACTUAL VOLTS	TURNS	ACTUAL VOLTS	TURNS	ACTUAL VOLTS	TURNS	ACTUAL VOLTS
100	4·6	394	1812	403	1853	414	1905	424	1952	435	2000
250	7·5	241	1810	247	1853	254	1905	260	1950	267	2000
500	9·0	201	1809	206	1854	212	1908	217	1953	222	1998
1000	12·5	146	1813	149	1851	152	1900	156	1950	160	2000
1500	15	121	1815	124	1860	127	1905	130	1950	133	1995

NORMAL LINE PRESSURE = 11000 VOLTS.

KVA	V/T	AT − 5% TAP PHASE VOLTS = 6037		AT − 2½% TAP PHASE VOLTS = 6196		AT NORMAL TAP PHASE VOLTS = 6355		AT + 2½% TAP PHASE VOLTS = 6514		AT + 5% TAP PHASE VOLTS = 6673	
		TURNS	ACTUAL VOLTS	TURNS	ACTUAL VOLTS	TURNS	ACTUAL VOLTS	TURNS	ACTUAL VOLTS	TURNS	ACTUAL VOLTS
100	4·6	1312	6037	1347	6196	1381	6355	1416	6514	1450	6673
250	7·5	806	6037	826	6196	847	6353	869	6516	890	6675
500	9·0	671	6039	688	6192	706	6354	724	6516	741	6669
1000	12·5	483	6037	496	6200	508	6350	521	6510	534	6675
1500	15	402	6030	413	6195	424	6360	434	6510	445	6675

NORMAL LINE PRESSURE = 22,000 VOLTS.

KVA	V/T	AT − 5% TAP PHASE VOLTS = 12074		AT − 2½% TAP PHASE VOLTS = 12392		AT NORMAL TAP PHASE VOLTS = 12710		AT + 2½% TAP PHASE VOLTS = 13028		AT + 5% TAP PHASE VOLTS = 13346	
		TURNS	ACTUAL VOLTS	TURNS	ACTUAL VOLTS	TURNS	ACTUAL VOLTS	TURNS	ACTUAL VOLTS	TURNS	ACTUAL VOLTS
100	4·6	2625	12074	2694	12392	2763	12710	2832	13028	2901	13346
250	7·5	1610	12074	1652	12392	1695	12710	1739	13028	1779	13346
500	9·0	1342	12078	1377	12393	1412	12708	1448	13032	1483	13347
1000	12·5	966	12074	991	12387	1017	12710	1042	13025	1068	13350
1500	15	805	12074	826	12392	847	12705	869	13035	890	13350

As satisfactory parallel operation of two or more transformers is secured if their ratios do not differ by more than 0.5 per cent., it is perfectly permissible to modify the nominal ratios within this margin, and this may be done by varying slightly the nominally correct number of turns at the different tapping ratios, thus modifying the values of B and v/T. Actually this procedure only becomes necessary when the pressure of the windings to which the tappings are to be fitted is low, say, of the order of 440 volts. This is exemplified by Table I, which shows to what extent exact ratios can be obtained for three-phase core-type transformers of outputs ranging from 100 to 1,500 kVA, and for line pressures from 440 to 22,000 volts when fitted with plus and

*This information is only required when placing the *order* for the new transformer; it is of no importance in the quotation stages.

minus 2½ per cent. and 5 per cent. tappings. On the 440-volt windings only is it not possible to obtain *exact* ratios at all tappings, and even at this low pressure the discrepancies chiefly lie outside the ratio tolerance when the value of V/T approaches the pressure differences between the various tapping leads. In practice this case occurs only seldom, for instance, when tappings are fitted to l.t. secondary windings, and this provides a very sound reason for avoiding tappings on low-pressure windings. At the common higher primary pressures no difficulty arises in obtaining exact ratios at all tappings on account of the large number of turns in the h.t. windings, and, therefore, of the high ratios of V/T to primary pressure. The greater the number of frame sizes, *i.e.*, the closer the steps between core cross sectional areas, the more nearly will it be possible to approach the exact turns ratio at all tappings, so that the manufacturer who is thus best equipped will best be able to obtain the ideal conditions.

In this connection it must be remembered that makers of core type transformers are in a considerably better position to obtain closer accuracy to desired ratios than are makers of shell type transformers, as the value of V/T for shell type transformers is approximately twice as high as for core type for a given kVA, frequency and induction density. This is on account of the differences in the general proportions of the magnetic circuits of the shell type as compared with those of the core type transformer, which gives approximately a doubled value to A in the shell type as compared to the core type transformer. In those few cases which do sometimes arise where it is not possible to obtain exact turns ratios on all tappings, the slight divergence from the ideal does not seriously affect the transformer loadings. Assume, for instance, two three-phase transformers A and B each of 500 kVA output, impedance of 3.5 per cent., and ratios at a particular tapping of 6,600/440 and 6,600/438 volts, *i.e.*, a ratio difference of 0.5 per cent. When the transformers are paralleled, the circulating current at no load is given by the equation——

$$\frac{E_A - E_B}{\frac{Z_A \cdot E_A}{100 \cdot I_A} + \frac{Z_B \cdot E_B}{100 \cdot I_B}} = \frac{440 - 438}{\frac{3 \cdot 5 \times 440}{100 \times 655} + \frac{3 \cdot 5 \times 438}{100 \times 660}} = 43 \text{ amps.}$$

which, when the transformers are loaded, overloads one transformer and underloads the other by the vector sum of a mere 6.5 per cent., as shown vectorially in fig. 1. A ratio difference greater than 0.5 per cent. would, however, be serious. So much then for the question of turns ratio, which it will have been seen offers no real difficulties whatever at the primary pressures which are now in common usage.

So far as the percentage impedance is concerned, it can generally be said that it is still easier to obtain the correct value for this to ensure satisfactory parallel operation. The percentage impedance pressure drop is made up of two components, and is given by the well-known expression—

$$Z = \sqrt{R^2 + X^2}$$

where Z = Percentage impedance pressure drop.
R = Percentage resistance pressure drop.
X = Percentage reactance pressure drop.

In most cases, certainly in all modern transformers, the pressure drop due to reactance predominates, and it is only in the older transformers that the reactance and resistance pressure drops are at all comparable in value. When new transformers have to be supplied to operate in parallel with older ones of very low impedances (such, for instance, as an impedance of 2 per cent. in a 500-kVA transformer), it is far sounder practice to design the new transformer for a higher (and modern) impedance value and insert a reactance coil in series with the older transformer than to perpetuate the obsolete low impedance design. The higher impedance value is then available for limiting the flow of fault current upon the occurrence of an external short circuit.

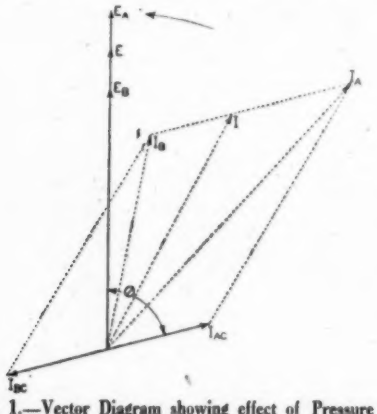


Fig. 1.—Vector Diagram showing effect of Pressure Ratio Difference on Transformer Loading.
I_{AC}, I_{BC}, circulating currents at no load in transformers A and B respectively.
I_A, I_B, total currents at full load in transformers A and B respectively.
$\text{Tan}\,\theta = (X_A + X_B)/(R_A + R_B)$.

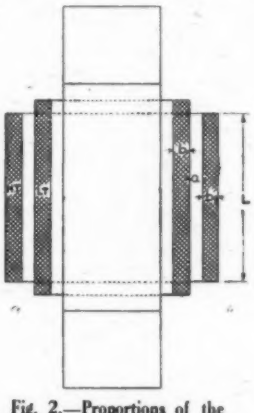


Fig. 2.—Proportions of the Electric Circuit affecting Transformer Reactance.

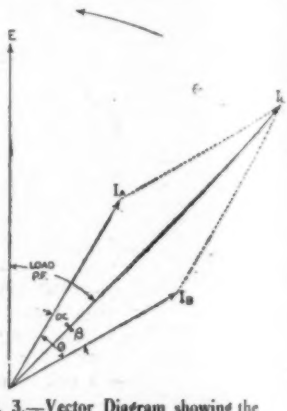


Fig. 3.—Vector Diagram showing the effect of a difference of the ratio of R/X upon Transformer Loading.

The percentage reactance pressure drop for single concentric core type transformers is given by the formula—

$$\text{Percentage } X = \frac{7{\cdot}9 \times \text{I.T} \times \text{M}\ell \times n}{\text{V/T} \times \text{L}} \left(a + \frac{b_1 + b_2}{3}\right) \times 10^{-4}$$

where I.T = Total ampere turns in either primary or secondary winding.
Mℓ = Average mean turn of h.t. and l.t. windings.
n = Frequency in cycles per second.
V/T = Volts per turn.
*L = Axial length of the shorter winding, h.t. or l.t.
a = Radial distance between h.t. and l.t. windings, copper to copper.
b_1 = Radial depth over copper of l.t. windings.
b_2 = Radial depth over copper of h.t. windings, all dimensions being in centimetres. These proportions are illustrated in fig. 2.

Assuming that the value of V/T has been fixed from a consideration of turns ratios, the above formula shows clearly that the percentage reactance can be varied over wide limits by varying the configuration of the h.t. and l.t. coil cross sections and the radial distance between h.t. and l.t. coils. For instance, a low value of L, *i.e.*, coils of short axial lengths, produces a high reactance which incidentally is accentuated by the fact that for a given output the values of Mℓ, b_1 and b_2 would increase with decreasing L. An increase of the radial distance a between h.t. and l.t. coils would also increase the re-

*For both mechanical and electrical reasons the two windings should be as nearly equal in length as possible, and the reference to the shorter winding is only intended to apply to small unavoidable differences.

actance. A decrease of reactance would be obtained by increasing L, and, therefore, the core length which would correspondingly reduce the values of Mt, b_1 and b_2. The value of a should not be reduced below the amount necessary for adequate insulation purposes *and oil circulation*. The reactance can, however, be reduced further (when necessary) by splitting up the h.t. and l.t. coils and interleaving them, forming, say, a group of L.H.H.L. coils. By this means the oil ducts can be maintained at reasonable widths. Generally a compromise between the different variables is effected when the desired reactance varies appreciably from the maker's standard. It is, for instance, undesirable to make L too small, as deep (radially) coils would result, and local internal heating of the coils might take place. On the other hand, if L is made too large, the core limb becomes mechanically weak, and the core structure is liable to become noisy in service. It is very rarely, however, that a skilful manipulation of the quantities L, a, b_1 and b_2 cannot be made to produce any reasonable value of percentage reactance pressure drop to ensure satisfactory parallel operation.

Any difference in the impedances will cause the transformers to take currents which are proportional to their respective outputs, and inversely proportional to their impedances, but satisfactory parallel operation is always ensured when the impedances are within a 10 per cent. limit of the theoretically desired values.

The final point to consider is that of the ratio of resistance to reactance pressure drops. If two transformers operating in parallel have different ratios of R to X, the effect will be to produce load terminal currents in the transformers which are out of phase with the line load currents and which will have arithmetic sums greater than the line load currents. A considerable difference in this ratio is permissible, however, before any serious overloading occurs.

Consider, for instance, two three-phase, 500-kVA transformers A and B both having ratios of 6,600/440 volts and impedances of 3.5 per cent., but ratios of R to X of 0.75/3.42 in transformer A and 1.75/3.03 in transformer B respectively.

The formulæ for determining the load current distribution are as follows:—

Line terminal current I_A in transformer A

$$= \frac{I_L \cdot N_A}{\sqrt{(N_A^2 + N_B^2 + 2N_A \cdot N_B \cdot \cos\theta)}}$$

Line terminal current I_B in transformer B

$$= \frac{I_L \cdot N_B}{\sqrt{(N_A^2 + N_B^2 + 2N_A \cdot N_B \cdot \cos\theta)}}$$

where I_L = total load current in amps.

$N_A = K_A/Z_A$

$N_B = K_B/Z_B$

$\theta = (\tan^{-1} X_B/R_B) - (\tan^{-1} X_A/R_A)$

$\beta = \sin^{-1}(I_A \cdot \sin\theta/I_L)$

$\alpha = \theta - \beta$.

and where—

K_A, K_B = Normal rated outputs in kVA of transformers A and B respectively.

Z_A, Z_B = Percentage impedance pressure drops of transformers A and B at their respective normal full load ratings.

X_A, X_B = Percentage reactance pressure drops of transformers A and B at their respective normal full load ratings.

R_A, R_B = Percentage resistance pressure drops of transformers A and B at their respective normal full load ratings.

θ = Phase angle difference between the load currents I_A and I_B in transformers A and B respectively.

β = Phase angle difference between the total load current I_L and the current I_B in transformer B.

α = Phase angle difference between the total load current I_L and the current I_A in transformer A.

Fig. 3 show the conditions vectorially, and from the above equations we get the following results:—

$I_L = 1{,}310$ amps.
$I_A = 663$ amps.
$I_B = 663$ amps.
$\theta = 17.63$ degrees.
$\beta = 8.8$ degrees.
$\alpha = 8.83$ degrees.

It will be seen then that even a difference of 125 per cent. in the values of R for the two transformers produces almost no overloading effect on the transformers. The overloading may, however, be appreciable in low impedance transformers having a high ratio of R to X unless steps be taken in the design of the new transformer to preserve a close equality of this ratio, or unless reactance coils are placed in series with the older transformer in order to permit the use of a more modern design of the new transformer.

The foregoing review indicates in brief outline the features that are involved in the design of transformers for parallel operation, and from what has been said it will at once be apparent that there is no real difficulty in ninety-nine cases out of a hundred in designing new transformers to operate in parallel with existing transformers of another make.

The Tramways and Light Railways Association.

The annual general meeting of the Tramways and Light Railways Association was held at Caxton Hall, London, on Friday, February 27th, Mr. W. G. Verdon Smith (Bristol Tramways and Carriage Co.) presiding.

The chairman, in the course of his speech reviewing the work of the Association during the past year, said the financial result of the year's working was a slight credit balance which brought the aggregate surplus of income over expenditure to £751. After referring to the great loss which the tramway industry had suffered in the deaths of Mr. J. M. McElroy and Mr. J. B. Hamilton, he dealt at length with the competition of motor-'buses with tramways, and certain Press attacks upon tramways. Both company- and municipal-owned tramways had suffered from motor-'bus competition. Viewing the problem in its broad aspect, the chairman said that the principles of some form of control ought to be laid down, and it was to be hoped that the Departmental Committee, which was considering the licensing and regulation of hackney vehicles—to which the Association had submitted its views—would report soon and see its way to make recommendations to be embodied at an early date in legislation which would have the effect of mitigating the present unfair position. Company undertakings were in a worse position with regard to this matter than local authorities, because the local authority, as the licensing authority, did have some notice of what was likely to happen and could take some steps, perhaps, to meet the competition beforehand. On the other hand, the company-owned tramway undertaking was faced with the prospect of motor-'bus competition over its routes at any moment, and even if it were aware that application was being made for licences to run 'buses, the tramway company had no *locus* to oppose. As to the Press attack, the chairman said it was absurd to speak of scrapping tramways when it was remembered that the number of passengers carried last year was 4,444,000,000, an increase of over 95,000,000 over the previous year. As a matter of fact, schemes for tramway extensions continued to be brought before Parliament, and a striking instance of tramway enterprise was that of the Edinburgh Corporation, which a few years ago was faced with the problem of reconstructing its cable-car system and decided, after careful consideration of all systems, to adopt electric tramways. The attack on tramways was usually based on the unsatisfactory financial returns from the metropolitan tramway undertakings, especially the undertaking of the London County Council, but the critics did not make sufficient allowance for the important factors which militated seriously against the financial success of these tramways as compared with 'buses. In the first place, the tramways were excluded from the whole of the central area of the metropolis, so that passengers could not proceed across without changing cars, whereas the 'buses were allowed to travel through. Secondly, the unsatisfactory financial results in London were largely due to the heavy burdens placed upon the tramway undertakings as the result of the strike in March of last year, the managements being persuaded to accept these burdens on the Government undertaking that assistance would be given to tramways in the Metropolitan area by a Bill designed to regulate passenger traffic in London and reduce the wasteful and unnecessary competition. That Act had been passed,

but had hardly yet come into operation, and no financial benefits had as yet accrued to the tramway undertakings. It was significant that 'bus fares were higher on routes which were not served by tramways, and the 'buses did not issue workmen's tickets, whereas the tramways carried millions of workmen at very low fares. The total capital expended upon the L.C.C. tramway system at March 31st, 1924, was £16,588,862, of which £7,609,485 had been repaid, leaving unredeemed the sum of £8,848,582. The increase in values since the war, however, meant that the replacement figure of the L.C.C. tramway system to-day would be not less than 30 millions sterling, and one could not imagine that the people of London would listen to a proposal that their 30-million-pound undertaking should be thrown upon the scrap heap. Then there was the contribution to road maintenance, street widening, and rates which the tramways made and which, in the case of the L.C.C., was no less a sum than £340,000 in one year, whilst on the question of congestion of traffic and handling the traffic at the peak hours, all the transport experts of the country were unanimous that no other form of traction could approach the tramway for dealing with the masses of traffic which had to be dealt with night and morning. Whilst, with its low capital outlay, the motor-omnibus had bestowed upon sparsely-populated districts and rural communities travelling facilities of the greatest value, it was not possible to contemplate, as a justifiable step, either from the practical or economic point of view, the substitution of 'buses for tramways in the industrial and densely-populated cities and towns throughout the kingdom.

Among the other matters put forward were that the present position with regard to increased fares under the Tramways (Temporary Increase of Charges) Acts, 1918 and 1920, should be placed upon a permanent basis in order to place undertakings in a more secure position, a step which could be taken without detriment to the public; the Rolling Stock Joint Committee was expected to report in the near future; experiments were still being carried out with the slipper type of trolley-collecting gear, but its use in many places had been discontinued owing to excessive wear of the trolley wire; the Council continued to urge that rear lights should be carried by all vehicles; and the British Engineering Standards Association had been asked to undertake the preparation of a specification for tramway rails suitable for use in the sleeper type of track construction. On the subject of wages, it was pointed out that the agreement come to on November 17th last was subject to three months' notice which, however, could not be given until December 31st, 1925, so that in effect wages were now stabilised until March 31st, 1926.

In the course of a short discussion on the chairman's speech, Alderman Smithson (Leeds) said that so convinced was the Leeds Tramway Committee of the fact that tramways had come to stay, that it was recommending an expenditure of £500,000 upon rolling stock.

Mr. C. J. Spencer (Metropolitan Electric Tramways, Ltd.) said that it was absurd to speak of substituting 'buses for tramways for handling mass traffic in densely-populated areas, as the chairman had pointed out. At the present moment in the Metropolitan area there were 3,000 tramcars and 5,000 'buses, each carrying approximately 1,000 million passengers per annum. If the tramcars were dispensed with, the 1,000 million passengers they now carried would still have to be handled, and therefore at least another 5,000 'buses would be needed to do the work. As a matter of fact, to meet the peak-load conditions would require 6,000 'buses, and the streets were not wide enough to take them. The cost per car-mile to run a 'bus was about the same as that of running a tramcar, so that the fares would have to be increased to meet the extra cost of running 6,000 'buses as compared with 3,000 tramcars. The problem of London traffic could only be met by careful consideration on the part of people who had knowledge and experience and by an examination of every aspect of the subject, and not by cheap sneers at one form of traction as compared with another. There was no city in the country so badly served as regarded regulation and co-ordination as the metropolis, where it seemed to be assumed that the policy of unrestricted competition was the best. What would be the position if electric light, gas, and water companies were allowed to compete in the same streets? The result would inevitably be that the public would have to pay more for its particular commodity. That was actually the position in transport to-day, despite the fact that the public had so large a choice of means of conveyance. Moreover, this very fact was responsible for a passenger getting to his destination in a much longer time than would otherwise be the case. The answer to the suggestion that tramways should be placed underneath the roads was simply that the money did not exist with which to do it, however ideal the proposal might be. The great essential was co-ordination and regulation, because whilst it was foolish to speak of scrapping the tramways, it was equally foolish to speak of scrapping 'buses.

Mr. Fred. Bland (Sheffield) expressed the view that the paper that had been carrying on the campaign against tramways did not represent public opinion upon this matter.

Mr. Marshall Harris suggested that the influence of the campaign in question was not so serious as had been imagined, for when he attempted to run motor-'buses outside his area, the authorities there claimed that he should put down tramways and so contribute towards road maintenance, street widenings, and rates.

The following were elected members of the Council:—

Mr. Fred. Bland (representing the manufacturers); Mr. W. V. Edwards (Hastings Tramways Co.); Mr. P. M. Rosdale (British Electrical Federation); Mr. A. R. Hoare (Messrs. Stephen Sellon & Partners); and Mr. M. V. Morland (St. Helens Corporation Tramways).

The Ideal Home Exhibition.

This year's Ideal Home Exhibition, organised by Associated Newspapers, Ltd., at Olympia, was opened on Monday last, and it will remain open until March 25th.

From the electrical point of view, the display is better than those of previous years, the principal improvement being an all-electric house arranged by the British Electrical Development Association jointly with the Electric Lamp Manufacturers' Association. We have already reproduced a plan of this (Elec. Rev., January 16th, p. 89), and given an idea of the arrangements (Feb. 13th, p. 246), but below we are able to supplement this general information by a more detailed survey.

It is also pleasing to see an increase in the number of electrical firms participating in the exhibition, and a widening in the range of their products.

The gardens are again equipped with "daylight" illumination, adding to their effectiveness during the dark hours.

The fountains in the centre of the main building and at the E.D.A. pavilion are also an addition of an electrical nature.

As a counterblast to the E.D.A. display, the gas industry has a similar model dwelling, with all-gas equipment, in close proximity to the "all-electric" house.

The E.D.A. Display.

It was not to be expected that the exhibit arranged by the E.D.A. would be as excellent as the Association's display at Wembley last year, but considering the short period of the exhibition, space limitation, and other very different conditions, the "all-electric" house compares very favourably with its larger prototype.

The visitor to the exhibition is immediately attracted by the large "Electric House" sign, and the electric fountain, and the entrance hall is warmly lighted by a lantern and wall brackets, extending a welcome. The number of the house and the outside step are illuminated, and in the entrance are a clock-switch by which lights can be switched on and off while the occupants are absent, and a "ringing" letter box actuated by the raising of the flap. The exigencies of space have compelled the Association to combine the lounge hall, living and dining rooms in one compartment. As a party of visitors enter, a bad lighting installation (exposed lamps in an electrolier) is switched on as a "horrible example." Then by a touch of a switch this is extinguished, and its place is taken by soft well-diffused illumination. Wall brackets and standards are used to give intenser local lighting. Heating is represented by a 1-3-kW electric fire, a pedestal heater, and a small heater for preventing down draughts from windows. It is shown how the heating can be made more effective by the use of a small electric fan. Low-temperature heating is used in a map and a screen, while there is also a heated footstool. The most interesting piece of dining-room furniture is a wired sideboard. Upon this are grouped the toaster, percolator, kettle, &c., which can be plugged in as required, there being just one connecting plug from the supply to the sideboard. As the visitors leave, a return is made suddenly to the original bad lighting; this is calculated to have the effect of making visitors avoid this in future.

In the bedroom the same comparison of good and bad lighting is made. It is shown that the best arrangement is a central fitting giving general diffused illumination and bracket lights above the bed and dressing table. Another electric fire appears in this room, and among other appliances which are on view are a bedwarmer, violet-ray appliances, milk warmer, scent diffuser, fan, &c. There is also a "security" switch by means of which a light can be put on in every room of the house in case of emergency.

The bathroom contains an electrically-heated towel rail and a hanger for warming or drying gowns; a radiant electric fire; an immersion heater; an illuminated shaving mirror; a shaving pot; and warmed boot trees. The bath water is provided by an electric geyser. The lighting is

specially designed, and the demonstration already mentioned is again made.

Garage lighting is as important as the illumination of the house, especially where the garage is also the workshop, as it is in the E.D.A. display. Angle reflectors are fitted in suitable positions to illuminate all parts of the car, and the work benches are separately lighted. A number of electrically-driven tools are shown here, the principal one being a lathe. In the garage are also a central vacuum cleaning plant, with pipes and nozzles to each room, which can also be used for blowing the dust out of the car; a self-contained electric refrigerator; and an automatic charging machine for radio or automobile batteries. The kitchen is illuminated by a dustproof central fitting and there is a separate bracket over the sink. In this room the virtues of the electric vacuum cleaner are demonstrated apart from the main business—cooking. A typical electric range has been installed for demonstration purposes, and the utensils employed in conjunction with it include a kettle, fish frier, and frying pan. There are also a hot cupboard an electrically-driven sewing machine, and a bell and indicator.

Even in the scullery good lighting is essential, and the way of providing it is shown. The appliances in this compartment are a washing machine, irons, a plate washer, and a drying cabinet, as well as an electric boiler with thermostatic control.

Not the least important part of the display is the inquiry bureau at which information of all kinds relating to the supply and use of electricity can be obtained. A prominent feature of this bureau is that definite information as to costs can be given to each visitor, as the rates of all authorities are available there. The opportunity is taken of exhibiting a dictaphone, tabulator, duplicator, and other electrical office appliances.

The Institution of Electrical Engineers.

Annual Dinner of the North-Western Centre.

The annual dinner of the North-Western Centre of the I.E.E. took place on February 27th, at the Midland Hotel, Manchester, the Chairman of the Centre, Mr. H. C. Lamb, presiding. Among the guests were the President of the Institution (Mr. W. B. Woodhouse), the Lord Mayor of Manchester (Alderman F. J. West), the Mayor of Salford (Alderman G. Billington), Mr. Austin Hopkinson, M.P., Mr. E. A. Radford, M.P., the Dean of Manchester (Dr. Hewlett Johnson), and Principal B. Mouat Jones.

In proposing the toast of "The City and Trade of Manchester," Dr. S. Z. de Ferranti said the history of Manchester as a trading centre began with the establishment of the cotton industry, and this was followed by the development of engineering to an extent not always realised even in the city itself. It offered so attractive a field that electrical engineers came there in great numbers and worked on a very large scale. They had made this section of the Institution a very important one. The city had now become the greatest trading centre in this country, and its trade was so diversified in character that it did not suffer in bad times, such as the last few years, as much as other places where industry was of a more specialised and restricted type. From the point of view of manufacturing it had a most suitable position, and since the making of the Ship Canal had given easy access to the sea it had become one of the leading seaports.

The Lord Mayor of Manchester, in responding to the toast, said the progress of the city largely depended upon the skill of the engineer. In return, through its civic services, it contributed in no small degree to the success of the firms engaged in electrical engineering.

The toast of "The Institution of Electrical Engineers" was proposed by Mr. Austin Hopkinson, M.P. He said at the present time industry was suffering from the interference of politicians who entertained the foolish idea that it was possible to bring peace and prosperity to it by political means. The Trade Union Levy Bill was typical of the sort of pettifogging tinkering legislation which should be avoided at all costs. Socialism was now a burst bubble, and an ideal which had been shattered should be replaced by a better one. Many men in the trade unions were disgusted with the use which had been made of them for political ends, and were endeavouring to revive sane trade unionism and make the Unions beneficent in their action. But they strongly objected to interference from outside. The Wireless Telegraphy Bill was drafted with such ambiguity of language that it ought never to become law. The subject was one which could be better dealt with by members of the Institution who had a knowledge of technical problems than by politicians who knew nothing about any problems.

Mr. W. B. Woodhouse, the President of the Institution, replying to the toast, said the members who lived outside London had been given a share in the government of the Institution, a wise policy which enlisted their sympathy and support. Each year the local Centres appointed the chairmen who were their representatives, and the Council was strengthened by hearing the views expressed by these gentlemen at the meetings, and by being brought in contact with the members in all parts of the country.

No electrical engineer would under-rate the importance of the North-Western Centre. The honour conferred upon Sir Benjamin Longbottom was not only a recognition of the great work he had done in connection with the Electrical Manufacturers' Association; it was also a special honour to the North-Western Centre. Many other distinguished names could be mentioned. He thought the members of the Centre appreciated very fully the way in which the world was looking to the electrical engineering profession with a wistful hope that through some miracle achieved by it the troubles from which the country was suffering would be removed. Probably the members did not take quite that view. They realised that a great deal of energy must be put forth, and that nothing great could be done without working together. That was the spirit which animated the nation at the beginning of 1918, when the whole country pulled itself together; and he believed the solution of the present difficulties was that they should once more pull together.

This was a wonderful time to live in. Various departments of science—heat, sound, electricity and so forth—had been developed separately without real co-operation; but it seemed to him they were on the eve of discoveries which would co-ordinate the work of research in all these sections. So also with the many sections into which the engineering industry was divided, co-ordination among them would help the solution of industrial problems, and also, in many matters which engineers were inclined to regard as outside their sphere, much help would be got by the application of the methods of analysis, and primary regard to truth and accuracy, which were essential in engineering progress.

The Council of the Institution had considered the Wireless Bill and took the view that in its present form it was likely to be harmful to electrical development. It had made representations to the Government asking to be allowed to put forward a reasoned criticism of the Bill.

The toast of "Our Guests" was proposed by the chairman in a humorous and able speech and replied to in similar style by the Dean of Manchester and Principal B. Mouat Jones. The attendance, over 220 members and guests, was the largest recorded in the history of the Centre, and the music and speeches were alike very enjoyable.

A Report on the British West Indies.

Mr. J. L. Wilson Goode, Trade Commissioner for the British West Indies and Central America, has forwarded a report upon the economic and financial conditions in the British West Indies and other contiguous British possessions to the Department of Overseas Trade. (Stationery Office, 1s. 6d. net.)

Mr. Goode says that there are possibilities of increasing the United Kingdom trade in electrical goods, but it is essential for a wide range of articles to be stocked locally to avoid delays. One reason for the strong hold which America has secured in this market, is that at the time when the local electrical companies commenced operations American material was cheaper than any other and American standards were adopted. During 1923 the Port of Spain electric lighting and tramway rules were so amended as to permit of the installation of British electrical fittings which comply with the I.E.E. rules. Until then the regulations of the National Board of Underwriters of America were the standard. Details of the countries of origin of electrical apparatus supplied during 1922 and 1923 to Barbados, British Guiana, Trinidad and Tobago, and Jamaica, are given in the report. The total value of this trade during 1923 was £71,533, as compared with £73,540 in 1922. Great Britain's share was valued at £22,593 in 1923 and £15,233 in 1922. At the same time the value of goods supplied by the United States fell from £53,626 to £44,832.

In dealing with communications the report mentions the cessation of the annual subsidy to the West India and Panama Telegraph Co. and the arrangements for linking up the Colonies by means of an all-British cable to be joined up with the Halifax and Bermuda cable by a new line between Turks Island and Barbados, with spurs to Trinidad and British Guiana. Communication with the smaller islands will be arranged by radio-telegraphy.

The tramway and electric lighting concessions of the Jamaica Light & Power Co. were, in 1923, taken over by a new corporation, the Jamaica Public Service Co., Ltd., with a capital of £1,500,000. Important improvements have already been introduced. The question of electrifying the Bridgetown tramway system has been under consideration for some time. An American syndicate commenced the work, but the war broke out and the project has since been in abeyance.

Seven new high-power radio stations are in course of erection in the British West Indies. The station at Barbados is nearly completed, and in Antigua and St. Kitts the foundations have been laid and the erection of the masts is in hand. An early start will be made on the stations at Dominica, Grenada, St. Vincent, and St. Lucia. [Since the Report was written these stations have been completed.—Eds.]

Among the other matters mentioned in the report are the authorisation of the expenditure of £428,000 by the Kingston (Jamaica) General Commissioners on an electricity scheme, including public lighting, &c.; the building of a water supply dam by a British firm at Hermitage (Jamaica) in connection with which a hydro-electric station is to be erected; and the erection of an electrically-operated crushing and drying plant in British Guiana for the treatment of bauxite ore.

Legal.

Tungstalite, Ltd., v. Raymond.

In the Chancery Division, on February 25th, Mr. Justice Romer heard a motion by plaintiffs for an injunction restraining alleged infringement by Kate Raymond, of Lisle Street, W.C., of their trade mark.

Mr. Moritz, for plaintiffs, said they made crystals for use with wireless sets and they had an enormous sale. Plaintiffs had bought from defendant some crystals which they found to be spurious. The crystals were packed in bottles which were like those of the plaintiffs, and the bottles bore labels which were a close imitation of theirs. The defence, he said, was a curious one, *viz.*, that if spurious crystals were sold it was done innocently, and that no such purchases as the plaintiffs alleged were made; in other words, said Mr. Moritz, that this was a "plant" on the defendant.

Sir Duncan Kerly, K.C., for the defendant, denied that his client had sold anything spurious, or that she sold the goods in question, or that the goods in question were spurious. No means had been suggested to him by which the alleged spurious articles could be distinguished, but, as the sale of these crystals was of no particular importance to him, he offered not to sell them if he could have a speedy trial.

Mr. Moritz accepted this undertaking, and his Lordship gave facilities for a speedy trial.

British Thomson-Houston Litigation.

The case of the British Thomson-Houston Co., Ltd., against the Universal Manufacturing Company came before Mr. Justice Astbury in the Chancery Division last Friday, on a motion by the plaintiffs against the defendants.

Mr. Trevor Watson said he had to move *ex parte* for an injunction to restrain infringement of the plaintiffs' two patents, one relating to gas-filled lamps and the other to the leading-in wires.

His Lordship: Is the case in ordinary form?

Mr. Trevor Watson said it was, and they had three affidavits supporting it.

His Lordship: Very well; injunction over next Friday.

Electricity Supply Company's Claim.

In the Mayor's and City of London Court, on February 24th, before Mr. Registrar Dell, a claim was made by the County of London Electric Supply Co., Ltd., Moorgate Court, Moorgate Place, E.C., against Mr. L. C. Cottee, Camberwell New Road, for £6 9s. 10d. excess cost of laying a service from the main to the defendant's house. Mr. H. Strouts, solicitor for the plaintiffs, said that the defendant in his defence stated that he had been informed there would be no charge for running the cable from the main to the house. Mr. Strouts said that in the conditions, which were all placed upon the application form which the defendant signed, it was set out that where the company's service mains were within 60 ft. of the highway the service would be laid free of charge, but beyond the highway, and where the service was carried over private property, the expense of laying the mains would be payable by the consumer. In the defendant's case plaintiffs had laid the mains over private property to the extent of 67 feet, but instead of charging the defendant for 67 feet they had remitted the charge for 30 feet as a matter of grace and charged for 37 feet only at 3s. 6d. per ft. The defendant said that he had been informed by the Macfarlane Electrical Co., who he considered were the agents of the plaintiffs, that upon his agreeing to take electrical energy there would be no charge for laying the service. The company's mains were 65 feet away from his house, and including the measurement from the mains to his meter he considered he was only responsible for 21 ft. The plaintiffs could not be said to have laid the mains upon private property because the pathway along which the mains were laid was used by himself and his neighbour. The Registrar said that the Macfarlane Electrical Co. were not agents for the plaintiffs. For the purpose of the contract the pathway along which the mains were laid was private property, and the plaintiffs were entitled to the amount claimed with costs, and judgment was entered accordingly.

A Telephone Prosecution.

An unusual case was heard at Plymouth recently when a youth of 18 was charged with "maliciously causing to be wasted certain electricity belonging to the Postmaster-General." It was stated that the defendant was seen to go into a telephone kiosk at Devonport and take off the receiver, although he had obviously no intention of making a call.

Mr. P. W. R. Hill, General Inspector of the Post Office Engineering Department at Plymouth, said that a great deal of trouble had been caused recently by people tampering with the instruments in kiosks.

The magistrates fined the defendant 10s.

Reviews.

Friction Clutches. By R. Waring-Brown, A.M.I.A.E., F.R.S.A., M.I.P.E. Pp. viii + 124; figs. 77. London: Sir I. Pitman & Sons, Ltd. Price 5s. net.

Every engineer who has been responsible for the upkeep of friction clutches, must at some time or other, have experienced trouble and felt that some types leave much to be desired. In spite of troubles and difficulties, and for many obvious reasons, friction clutches have, during recent years, been more and more in request, with the result that many new and improved designs have been produced, while development has been greatly enhanced by the introduction of new friction materials.

This book is a primer, chiefly intended for students, and presents in a concise manner the fundamental principles involved in the design and operation of friction clutches. Many recent devices are illustrated and described, and many modern applications of friction clutches to different types of machinery are shown.

A number of useful points in designing clutches are given in the first chapter, and while these are generally known, they are carefully classified and are worthy of careful study.

The important question of friction materials is considered, and the results of tests of well-known and commonly used materials are tabulated. Various types of cone clutches are discussed, and it is rightly pointed out that the cone clutch, although one of the simplest forms of friction clutch that can be devised, will, if correctly designed, give very satisfactory results. An interesting form of double cone clutch is illustrated and described; the driving shaft carries two external clutch cones, one of which is constructed in such a manner as to form a bearing for the clutch shaft so that the latter will be perfectly co-axial with the driving shaft.

Disk clutches consisting of a series of disks arranged in such a manner that each driven disk is placed between two driving disks are considered in a long chapter, and the theory of the band clutch with its construction and application is gone into. A short chapter is devoted to the centrifugal type of clutch.

The general constructional details of clutches have frequently a considerable effect on the complete design and are therefore worthy of careful consideration; these details, which are practically common to any design of friction clutch, include springs, shafts, toggles, operating mechanism, collars, &c.; each of these details is referred to, and illustrations of the most important items appear.

A short chapter is given to machine tool clutches, and here, again, experience has shown that the smaller sizes are often far from satisfactory, mainly owing to the lightness of the parts composing the operating mechanism. The book concludes with particulars of special devices such as shock absorbers, a description of the "Benn" clutch, and the question of standardisation.

Although this book is primarily intended for students, all those mechanical or electrical engineers who are specially interested in this subject will find the information reliable, up-to-date, and of considerable practical value.

E. P.

Electrical Measuring Instruments, Part II. Induction Instruments, Supply Meters, and Auxiliary Apparatus. By C. V. Drysdale, O.B.E., D.Sc., and A. C. Jolley, A.M.I.E.E. Pp. 474; figs. 437. London: Published by Ernest Benn, Limited. Price 55s. net.

Now that the second volume of this remarkable book is available, electrical engineers may congratulate themselves upon having at their disposal a complete account of the principal types of commercial indicating instruments as they now exist. When looking through the 475 pages of Part II, instrument designers and users, of the older school, will with pleasure renew their acquaintance with the earlier forms of electricity meter, the ammeter, the voltmeter, the wattmeter, and the ohmmeter, and they will find attractive descriptions of the many ingenious devices that have led the way to the precise and sensitive commercial instruments of the present day. Other readers will study rather the authors' handling of theory, and they will observe that laborious mathematical treatment of instrument problems has for the time being given place to comparatively simple mathematical statements. Here, indeed, are equations corresponding to each great advance, but in nearly every instance they are established forms—won for the students of this generation by the electricians of the last eighty years or so.

The general impression created by this treatise will be that the period through which electrical engineering is now passing is characterised by settled opinions concerning ways and means of measurement, so far as relates to instruments for commercial purposes. This must not be interpreted as an indication that the work of the designer is at an end—for in view of wireless developments it has scarcely begun. The true explanation is that in the development of commercial electrical measuring instruments a definite stage has been reached, and that from this halting place new movements in many directions are to be expected.

Such halts before a new advance have more than once been experienced, and the electrical instrument maker has more than once moved in step with the rapid strides of the technical literature of his time. In the earliest stages of instrument development the works of W. Weber, Helmholtz, Maxwell, Rayleigh, and Kelvin, provided much of the impetus. Then Oliver Heaviside unlocked the gates, while the scientific papers

of Blakesley, Ayrton, Perry, Boys, and other familiar pioneers, taught the way to efficiency and precision. Meanwhile, writers more directly in touch with what Fleeming Jenkin called "a sort of floating science known more or less perfectly to practical electricians," produced books that made the task of the electrical instrument-maker more definite. It suffices to recall the work of Wheatstone, Latimer Clark, and Robert Sabine, the influence of the text-book written by Fleeming Jenkin, the effect of the treatise by Kempe on electrical testing, the inspiration of the series of contributions to the subject by Professor J. A. Fleming, beginning with his account of the alternating current transformer, and the simultaneous effect of developments in mechanical details, to realise how essential a stimulus to instrument-making has been its literature. There is good reason, therefore, to welcome the authors' work.

They begin with a statement of the general principles governing the design of continuous-current supply meters, including an account of electrolytic, rotary, and intermittent forms, and the various factors that determine the respective degrees of precision. They then proceed to the corresponding problems in alternate-current measurement. Particular attention is given to recording instruments, including details of pens, charts, drives, and damping. There is also an excellent chapter on the design of frequency-meters, phase-meters, and power-factor indicators, with an appendix on the theory of a loaded vibrating reed. Attention is then given to the design of transformers and other devices for extending the range of alternating current instruments. Another feature of the book is a chapter relating to electrical means for mechanical testing. In this section is an account of voltmeter tachometers, eddy-current tachometers, stroboscopes of various forms, Prony and band brakes, and transmission dynamometers. Constantinesco's alternating hydraulic system is also introduced as a by-product of electrical theory, and hydraulic "ammeters" and "voltmeters" are accordingly considered in conformity with electrical principles.

The book concludes with suggestions for test-room equipment, particularly with regard to problems of calibration and special tests. Curiously enough, although this section gives valuable advice upon the selection of methods of testing and apparatus, it omits to say what kind of galvanometer and what special forms of keys and switches are desirable for inclusion in the equipment. The void can be filled, however, by reference to the treatment of galvanometers in Part I. A book of this character requires no other eulogy than the statement that it is lucid, concise, and accurate. Incidentally, the work as a whole is a high tribute to the achievements of the physicists, electrical engineers, and instrument makers of this country; for it affords tangible proof of what the members of that brotherhood—and a brotherhood it is—have done towards providing the world with means for exact measurement.

Electrical Circuits and Installation Diagrams. By W. S. IBBETSON, B.Sc., A.M.I.E.E., M.I.Mar.E. Pp. viii + 186; figs. 175. London: E. & F. N. Spon, Ltd. Price 10s. 6d. net.

This collection of diagrams covers practically the whole range of everyday electrical engineering problems, the subjects dealt with being d.c. and a.c. motors, dynamos, alternators, transformers, converting plant, instruments, distribution and lighting, accumulator charging, testing, bells, telephones, and kinema arc controls.

The diagrams range from comparatively advanced controller circuits to connections of ammeters and voltmeters in continuous-current circuits.

The need for the former class is obvious. Regarding the latter class of diagram, the author may justify its inclusion as being a necessary step in the development of diagrams for power and energy measurement. The reviewer is, however, of the opinion that no one who needs such elementary diagrams can possibly be included in the class for which the book is intended—namely, "electrical engineers engaged in the operation and control of all kinds of power and lighting plants."

In his preface, the author claims that the majority of the diagrams are original. This may be so in the respect that they have been re-drawn by him.

Figs. 153 to 158 are devoted to the subject of testing. The information contained in the diagrams and the accompanying text is of a very elementary description, and anyone who has need of such information should not be allowed to make tests.

The printing and the reproduction of the diagrams are well done by the publishers, but the author would be well advised to study some of the modern diagrams produced by progressive radio engineers, so as to enable him to realise how much his work is below the present-day standard.

In the copy of the book perused by the reviewer figs. 176 and 177 were missing.

Business Notes.

Bankruptcy Proceedings. — B. E. DIXON, trading as the Creswick Dixon Electric Co., at Sheffield and Chesterfield, electrical engineer.—The receiving order in this matter was made on February 7th on debtor's own petition. The statement of affairs shows liabilities of £2,535, against assets of £330, or a deficiency of £2,205. Debtor attributes his failure to heavy expenses and incompetent assistants. It appears that he commenced business at Albert Road without capital in 1920. In December, 1921, he was joined in partnership by another, who brought in £350 capital. In September, 1922, a shop was opened in London Road which was managed by the partner. In October, 1923, a shop was opened in Chesterfield Road and put in the charge of the partner's daughter. In June, 1924, the partnership was dissolved, debtor agreeing to pay his partner £400, but no payment was made. The partner was subsequently employed at a salary of £5 a week until three weeks prior to the date of the receiving order. In 1924 debtor took a lease of premises in Chesterfield, and the business there was successful. He also opened offices and a showroom to start a mail order business. In August or September last he advertised for a man to act as manager of a branch shop, subject to a deposit as security, and he received a considerable number of replies, selected six of them, and received £600 as deposits. A fortnight before he filed his petition these men claimed the return of their deposits, and he arranged to transfer the Chesterfield business to them, but there was a difficulty in assigning the lease. He states that he then thought of floating a company in connection with the Chesterfield business, the six men to be allotted shares in it. They continued to press him, however, and he filed his petition. The creditors refused to assent to a deed of assignment. First meeting March 4th, at the Official Receiver's offices, Fig Tree Lane, Sheffield. Public examination March 19th, at the County Court Hall, Sheffield.

MAJOR DODGSON, Railway Station Yard, Bridlington, plumber and electrician.—The first meeting of the creditors of the above was held on February 26th at the Official Receiver's office, Scarborough. The statement of affairs showed gross liabilities of £749, of which £717 was expected to rank, against net assets of £146, or a deficiency of £571. Debtor attributed his failure to losses on contracts through depreciation of stock and increased cost of labour, also lack of capital. The case being a summary one was left with the Official Receiver as trustee. The following are creditors:—

	£		£
Bailey, R., & Sons, Ltd.	32	Raine Bros.	397
Hutchinson	62	Turner & Stevens	25
Martin, J., & Co., Ltd.	141		

G. W. RIDLEY (GEORGE RIDLEY), electrical engineer and contractor, 1, Alfred's Court, Chorley, Lancaster.—Receiving order made February 23rd, on debtor's own petition.

F. WILDE (LIVERPOOL ENGINEERING CO.), electrical engineer, 18 & 20, Vauxhall Road, Liverpool.—Trustee, Mr. L. Nicholas, 19, Castle Street, Liverpool, released December 18th, 1924.

S. L. BAPTY and N. MILES (WIRELESS INSTRUMENT MANUFACTURING CO.), wireless instrument manufacturers, Avenue Works, Avenue Road, Willesden, N.W.—Last day for proofs for dividend, March 16th. Trustee, Mr. E. H. Hawkins, 4, Charterhouse Square, E.C.

Company Liquidations.—BARCLAY'S RADIO STORES, LTD., 30, Stephenson Street, Birmingham.—A meeting of creditors was held on February 23rd at the offices of Messrs. Poppleton and Appleby, Birmingham. The chair was occupied by Mr. C. T. Appleby, the liquidator in the voluntary liquidation of the company, who submitted a statement of affairs which disclosed liabilities of £1,286, all due to unsecured creditors. The assets were estimated to realise £226, from which had to be deducted £52 for preferential claims, leaving net assets of £174, or a deficiency, so far as the creditors were concerned, of £1,112. It was reported that the company was registered in May, 1924, with a nominal capital of £500, to take over the business of Barclay's Stores, which had been carried on at the above address by Mr. J. B. Russon. Only two shares of £1 each had been issued, the holders being Mr. Russon and his wife. At the time of the incorporation there were liabilities of £600, whilst the assets were rather more than £300. The liabilities included a sum of £500 due to the Tele Radio Co., which was now a creditor for £423, but it had intimated that it would not make any claim in the liquidation. The turnover of the company had been approximately £100 a week. Last December a fire caused damage estimated at £400, but only £194 was received from the insurance company. Last December an action for infringement of patent rights was brought against the company, and judgment was given for an account and £50 costs. The total amount due in that direction had not yet been ascertained. The creditors decided to confirm the voluntary liquidation of the company, with Mr. Appleby as liquidator.

NAPIER-KIMBER, LTD.—Winding up voluntarily. Liquidator, Mr. S. H. Gillett, 24, Basinghall Street, E.C.

Meeting of creditors March 9th, at the Institute of Chartered Accountants, Moorgate, E.C. Particulars of claims by March 24th, to the liquidator.

Mills, English & Co., Ltd., 4, Castle Square, Swansea, electrical engineers.—A meeting of creditors was held recently, at Swansea, when the chair was occupied by the liquidator, Mr. C. H. Mills. The liquidator reported that a receiver had been appointed on behalf of the debenture holders, and he was now carrying on the business. The liabilities of the company as at February 4th, the date of the receiver's appointment, were as follows:—First debentures, £20,000; trade creditors, £20,500; and preferential creditors, £739. The assets consisted of:—Stock-in-trade, £20,000; good book debts, £12,400; and property in Wind Street, £25,000, making a total of £57,400, or a surplus as regarded the creditors of £16,161. The liquidator reported that the property was held on a lease with 80 years unexpired. It was valued in 1923 at the above figure of £25,000, and was considered to be worth that amount at the present time. The liquidator attributed the present position to shortage of working capital, depreciation of stocks, and pressure by creditors. The directors had endeavoured to obtain further capital, but without success, and voluntary liquidation was decided upon. The turnover had been approximately £80,000 to £120,000 per annum, but losses appeared to have been made each year since 1921. The liquidator stated, however, that he believed the receiver was carrying the business on at a profit, and he (Mr. Mills) and his co-directors suggested that if it were possible for the receiver to sell the property and clear off the debentures, the business might be reconstructed and the creditors asked to accept debentures in respect of their claims. It was stated that proxies amounting to £5,500 had been lodged in favour of the proposal.

The matter was discussed, and it was decided to confirm the voluntary liquidation of the company, with Mr. C. H. Mills as sole liquidator. An advisory committee was appointed, consisting of Messrs. British Mannesman Tube Co. (Swansea), Mr. G. G. Poppleton (Birmingham), and Messrs. Godwin, Warren & Co., Ltd. (Bristol).

Ashley Wireless Telephone Co., Ltd.—A meeting of members is called for March 30th, at the offices of Messrs. Bryce Hanmer & Co., 24, North John Street, Liverpool, to hear an account of the winding up from the liquidator, Mr. H. Dewhurst.

Weston Electric Lighting Co., Ltd.—Winding up voluntarily. Liquidator, Mr. J. Greenhalgh, 37, Mawdsley Street, Bolton. Meeting of creditors March 11th, at the liquidator's offices.

Refty Electrical Appliances, Ltd.—Winding up voluntarily. Liquidator, Mr. R. O. McGown, 57-58, Chancery Lane, W.C.

Private Arrangements.—C. M. Openshaw and J. Bradley, trading as the Acme Electrical Co., 106b, Church Street, Blackpool.—A meeting of creditors was held recently at the offices of Mr. J. W. Westhead, Blackpool, when a statement of affairs was presented, which showed liabilities of £125, the assets making a total of £31, or a deficiency of £94. It was stated that the business was commenced in November, 1923, by Openshaw, and a month later he was joined by Bradley, who brought in £50. In 1923 there was apparently a third partner, but he retired after a very short time. The present position was attributed to a strike last year, shortage of capital, keen competition, and the very small profits obtainable on contracts. The debtors did not propose to continue the business. A resolution was passed in favour of the estate being realised under a letter of authority to Mr. Westhead.

Allan Leslie, dealer in electrical goods, 219, Buchanan Street, Glasgow.—The creditors interested herein were called together recently, at Glasgow, when the chair was occupied by the representative of the largest creditors. A statement of affairs was submitted which disclosed liabilities of £1,109, made up as follows:—Sundry creditors £937 and cash creditors £172. The total assets were £254, from which had to be deducted £12 for preferential claims, leaving net assets of £242, or a deficiency of £867. The statement therefore showed an apparent dividend of 4s. 4½d. in the £, subject to the expenses of realisation. The debtor attributed his position to the state of the electric lamp trade. He made an offer of 5s. in the £, payable in six months, but there was no guarantee. There was an overdraft at the bank of £100, unsecured. The debtor commenced business in January, 1924, with a capital of £50, which was spent on fittings. His drawings had been at the rate of £3 a week. The debtor explained that the business was fairly successful until September last. In that month he obtained a rebate for the lamps, but by December the sale of the lamps had fallen away again. He had no discount on wireless goods.

The matter was discussed, and the creditors eventually decided to request the debtor to sign a mandate for summary sequestration.

Dissolutions of Partnership.—Bree, Jubb & Bree, electrical and general engineers, 33a, Ings Road, Wakefield. Messrs. R. D. and P. Bree and Mr. S. Jubb have dissolved partnership. Debts will be attended to by Messrs. R. D. & P. Bree.

Bagshaw, Tyas & Co., wireless and electrical engineers and manufacturers, 32, Burgess Street, Sheffield.—Messrs. G. W. Bagshaw, J. Bower, and A. J. Lambert have dissolved partnership. Debts will be attended to by Mr. Bower, who will continue the business under the same style.

Western Wireless Co., manufacturers and dealers in wireless sets, 9, High Street, Ealing.—Mr. B. A. Willmin and Mr. W. J. Sturley have dissolved partnership. Mr. Sturley will attend to debts and continue the business.

Trade Announcements.—Messrs. Charles Edwards and Co., wholesale factors of electrical goods, have removed their business to 140b, Victoria Street, Bristol.

The Foster Engineering Co., Ltd., has appointed Mr. F. Routledge, 21, Temple Lane, Dublin, as its agent for Ireland.

The Premier Electric Welding Co. is closing its Swansea works and extending the works at Abbey Wood, S.E.

Messrs. Stokes & Sellers, electricians, have commenced business at 25, Garden Street, Bury (Lancs.).

Mr. Frederick H. Burgess, electrical engineer, has opened new premises in Bridge Street, Stafford.

Catalogues and Lists.—The English Electric Co., Ltd., Queen's House, Kingsway, W.C.2.—Technical Guide No. 2,110, containing numerous illustrations and particulars of the company's ironclad oil circuit-breaker pillars; new publication, No. 453 (superseding one of October, 1923), describing and illustrating the Class OT and OS oil-immersed circuit-breakers; also No. 573 on "Steam Extraction or Pass Out Steam Turbines" (reprint of a paper by Messrs. J. P. Chittenden and W. S. Burge).

Messrs. Thomas Howse, Ltd., Union Works, Smethwick, Staffs.—A series of pamphlets containing details of exposure tests of various paints of the firm's production.

London Factors & Agents, Ltd., 38 and 39, Parliament Street, Westminster, S.W.1.—Price list of electrical accessories of all kinds.

Mr. Charles E. Douglas, 10, Gray's Inn Square, W.C.1.—An illustrated brochure dealing with small steam turbines made by Messrs. Scott & Hodgson, Ltd., Manchester.

Symplex Manufacturing Co., Harrow Road, Brislington, Bristol.—A leaflet advertising the "Marshall" battery tester, made by an American company.

The Ace Battery Co., Ltd., Crescent Works, Lutterworth.—Two priced catalogues dealing with "Ace" batteries for house-lighting and radio work respectively.

The Damard Lacquer Co., Ltd., Warwick Road, Greet, Birmingham.—An illustrated brochure describing the production of "Formite" bakelite mouldings, with a number of hints to designers, particulars of the material's physical and electrical characteristics, &c.

Premier Electric Heaters, Ltd., Keeley Street, Watery Lane, Birmingham.—Two illustrated pamphlets showing the application of a protective device to electric kettles.

The Bastian Meter Co., Ltd., Bartholomew Villas, London, N.W.5.—Circular describing Baty's two-valve receiver. Priced.

The Leicester Electrical Exhibition.—Mr. T. Percy Bentley writes to us pointing out that the exhibition that he is organising and which will be held at Leicester from October 8th to 17th, will be an "All-Electric" one—"industrial, scientific and domestic." He wishes to draw attention to this fact lest our remarks (Elec. Rev., February 20th, p. 282) describing it along with a number of other coming exhibitions as an occasion "for specialised demonstration effort rather than for exhibits of the 'Everything Electrical' description," should mislead any of our readers. We stated that it was to be a purely electrical exhibition "appealing largely to mining men and those interested in industrial electrical installations." Mr. Bentley says "The exhibition is to be essentially a national one. Leicester is central in the Kingdom, and it has great local mining and industrial interests."

Spanish Import Regulations.—On and after March 13th all foreign merchandise entering Spain must be accompanied by the original bill of sale, duly *viséd* by the Spanish Consul, in duplicate; while all shipments must be so accompanied, one copy of the sales invoice being available for the Spanish customs authorities, who are now engaged in framing a completely new valorisation plan for all foreign goods entering the country.—*Reuter's Trade Service* (Madrid).

Russian Purchases in 1925.—It is officially stated that during the current year Russia will purchase electrical products abroad to the value of 16,500,000 roubles.—*Reuter* (Moscow).

Electric Meter Manufacture.—Messrs. Parkinson & W. and B. Cowan, Ltd., are offering 100,000 seven per cent. preference shares and 50,000 ordinary, all of £1 each, for subscription, the list closing to-day. Part of the issue is required for the development of the company's electricity meter business, which has not yet contributed to the parent company's profits. The directors are gratified at the prospects, the demand for meters is increasing, and substantial returns are anticipated in the near future.

Leicester Electricians' Wages. — A meeting of the Anomalies Committee of the Whitley Council was held at the Nottingham Guildhall, on February 26th, when it was decided to recommend to the full Council the adoption of certain rates of pay for ten grades of employés in connection with the Leicester city electricity undertaking. The District Joint Board also held a meeting, and dealt with a report relating to the training of technical engineers. Recommendations with regard to this matter are to be made to the National Council.

Esthonian Tariff Alterations.—The import duty on electric generators, motors, transformers, &c., has been raised from 5 marks per kg. to 7 marks per kg., and on "galvanic cells" from 1.20 marks to 2.50 marks per kg., whilst that on insulators has been reduced from 8 marks to 4 marks per kg.

Scottish Electricians' Strike.—In consequence of a dispute between rival unions forty electricians employed by Messrs. Harland & Wolff, Greenock, came out on strike on February 23rd. The Executive of the E.T.U. approached the firm in the matter, but the latter is stated to have declined to take any action.

Tramway Employés' Wages.—The Newcastle Transport and Electricity Committee has increased the wages of motormen and conductors by 1s. 6d. per week.

German Electrical Exports in 1924.—The total exports of the German electrical equipment industry during the year 1924 were 75 per cent. of the 1913 figures, according to advices received by the U.S. Department of Commerce. It is stated that in many instances articles are being sold below the present cost of replacement. Since the war American manufacturers have gained ground in markets formerly considered German monopolies. The German price level has been seriously reduced by domestic competition.—*Electrical World.*

Chinese Notes.—The Ming Ming Electric Light Co., Chinhai (Chekiang province) is increasing its capital from $50,000 to $100,000.

The Anking Electric Light Co. (Anhwei province) is establishing a new branch power station outside the city. New plant has been ordered from Germany.

The Whason Electrical Manufacturing Co., started about six years ago by Chinese, as a result of the inability to obtain electrical appliances during the war, has already turned out goods to the value of $350,000. The company makes dynamos and motors up to 25 kW, direct-coupled steam generating sets up to 4 kW, oil-cooled transformers up to 20 kVA, switchboards, meters, fans, and cooking and heating appliances.

Industrial Psychology.—Dr. C. S. Myers, Director of the National Institute of Industrial Psychology, gave evidence last week before the Balfour Committee on Industry and Trade on the place of psychology in industry and commerce. Among other things, he said that the modern need in large works was the establishment of a department of persons specially trained in industrial psychology, who should be at least of equal rank to those of engineering and finance. He referred to the considerable advances that had been made in Germany, where no secret was made of the belief that by concentrating attention on the human factor in industry and commerce she would obtain the same advantage as she secured in pre-war days by her attention to the material and mechanical factors. Dr. Myers said that departments of industrial psychology had been introduced with undoubted success into large German concerns such as Krupps, Osram, Siemens, Zeiss, the A.E.G., the Post Office service, the State Railways, Tramways, &c.

Book Notices.—"Railway Rates: How They Affect the Cost of Living." (21 pp.) London: Railway Clearing House.—This pamphlet has been compiled to show the small proportion which the cost of carriage forms of the cost of food to the consumer. The figures, which are, of course, *ex parte*, are very striking

"The *Electrician* Electrical Trades Directory and Handbook, 1925" (the "Blue Book"). 1,413 pp. London: Benn Bros., Ltd. Price 25s. net.—This is the 43rd edition of this well-known directory and compendium of information regarding the electrical industry. All the principal features remain unchanged except for the necessary revision. The review of the law relating to electricity supply, however, has been entirely re-written in the light of recent developments.

"The *Journal* of the South African Institution of Engineers." February, 1925. Johannesburg: The Institution. Price 2s.—This issue of the *Journal* contains a paper by Mr. T. E. C. Stanton on "The Factor of Safety of Boilers," followed by a discussion on the subject.

"Science Abstracts" (A. & B.). Vol. XXVIII. Part 2. February 25th, 1925. London: E. & F. N. Spon, Ltd. Price 3s. each. net.

The February issue of *Contact* contains the annual report for the year 1924, presented to the annual general meeting of the National Association of Supervising Electricians on February 10th, which shows good progress and a healthy condition. About one-third of the applications for membership were declined. Many members secured appointments through the Employment Bureau.

"Organisation and Administration of the Electricity Undertaking," by C. L. E. Stewart. Pp. ix + 169. London: Sir Isaac Pitman & Sons, Ltd. Price 6s. net.

"Electrical Engineering," by L. A. Hazeltine. Pp. xvi + 625; figs. 364. London: Macmillan & Co., Ltd. Price 30s. net.

"Construzioni Elettromeccaniche," by E. Morelli. Vol. I L80, Vol. II L75, Vol. III L36. Turin: Unione Tipografico-Editrice Torinese.

"Sell's Directory of Registered Telegraphic Addresses." (Pp. 2,935.) London: Business Dictionaries, Ltd. Price 45s.—This is the fortieth annual appearance of this useful directory, and each year its size increases. The present edition contains brief particulars of some 130,000 firms under 3,500 trade headings, which makes it a valuable reference book for many purposes.

"Full Value for Money in Life Assurance," by R. Morris. London: Hutchinson & Co., 1s.

"The History of the Telephone in the United Kingdom," by F. G. C. Baldwin. Pp. xxvi + 728; figs. 186. London: Chapman & Hall, Ltd. Price 42s. net.

Calendar.—MESSRS. MCWHIRTER & SONS, LTD., of Wharf Street, Cardiff, have sent us a wall calendar with daily slips.

Local Electrical Exhibition.—Last week the Blackpool General Purposes Committee approved of the proposal to hold a six weeks electrical exhibition at Blackpool next winter. A deputation of electrical contractors and dealers waited on the committee to explain their attitude with reference to the idea of a permanent showroom, and it was pointed out that the Corporation did not propose to enter into competition with private traders in the supply of electrical appliances, but merely to demonstrate them to the public.

A New German Cable Factory. — The German Cable Works Co., of Berlin, reports that during the past few years the company has carried out considerable extensions of its Berlin installations. In addition a new cable factory has been established at Ketschendorf, near Furstenwalde-Spree, and it has already begun operations.

Works Committees and Harmony.—In the course of his speech at the annual meeting of Messrs. Mather & Platt, Ltd., at Manchester, on February 27th, Mr. Loris E. Mather said that during 1924 their output was maintained, though they had to be content with reduced profits, due to very keen competition, both at home and abroad. Their relations with their men had continued throughout the year to be of the happiest character. "This," said Mr. Mather, "I attribute in no small measure to the work done by our Works Committee, which meets once a fortnight and discusses freely and openly any difficulties or misunderstandings which arise before they have time to become serious. I am sure that if the directors of every engineering works in the country would realise that a Works Committee, constituted as agreed between the Engineering Employers' Federation and the trade unions, and consisting of representatives from the employés and the management, meeting regularly on a basis of equality, ought to be an essential part of their organisation, there would be less heard of restriction of output and other similar troubles which affect the industry." With reference to the trade outlook, the speaker went on to say that there was still much uncertainty, but they had started the year well, and, with more settled conditions on the Continent of Europe, they looked forward with confidence to improvements in many of the markets which had since the war been of little benefit to them. Their home trade was quite good last year and continued to show an increase. There was a steady flow of orders from Egypt, India, and the Far East; and, in the West, they could report more inquiries from South America, which had been a very good market for the company in the past.

Electrical Imports of Tunis.—The recently-issued official statistics of the foreign trade of Tunis contain some particulars of the value of the imports of certain electrical goods in 1923. These are given below, the corresponding figures for 1922 being added for purposes of comparison:—

	1922. Francs.	1923. Francs.	Inc. or dec. Francs.
Dynamo-electric machinery—			
Total	3,053,000	2,333,000	– 720,000
Inclu. from France ...	3,022,000	2,167,000	– 855,000
" " Great Britain	2,700	26,000	+ 23,300
" " Sweden ...	—	97,000	+ 97,000
Accumulators—			
Total	255,000	130,000	– 125,000
Inclu. from France ...	255,000	122,000	– 133,000
" " Sweden ...	—	3,000	+ 3,000
" " United States	—	3,000	+ 3,000
Armatures and other spare parts for electrical machinery—			
Total	6,183,000	5,448,000	– 735,000
Inclu. from France ...	5,859,000	5,303,000	– 556,000
" " Belgium ...	3,500	38,000	+ 34,500
" " Italy	32,000	53,000	+ 21,000
" " United States	33,000	17,000	– 16,000

Patent Application.—Application has been made for the restoration of Patent No. 172,153 of 1920, granted to F. H. Royce for "Improvements in relation to electrical turning gear for starting internal combustion engines."

New French Company.—A new company has lately been formed in Marseilles with a capital of 85 million francs and the title La Société d'Electricité de Marseille, to take over the two electricity supply undertakings in that city, one of which also controls the gas supply.

British Trade Mark Applications. — The following are among the recent applications for British trade marks. Objections against any of the marks may be lodged within one month from February 25th:—

Beltona (lettering and design). No. 455,096. Class 8. Apparatus for use in wireless telegraphy and telephony.—John G. Murdoch & Co., Ltd., 59-61, Clerkenwell Road, London, E.C.1.

Hexaphone. No. 455,527. Class 8. Headphones.—W. Clark, 53, Victoria Street, Westminster, S.W.1.

F.W.W. (lettering and design). No. 451,664. Class 8. Electric incandescent lamps (ordinary).—Julius Axelrad, 25, Mornington Crescent, London, N.W.1.

New Municipal Showrooms.—As part of a reconstruction scheme at the Hampstead Borough Council's electricity works, a showroom has been opened to demonstrate the uses of electrical domestic appliances.

The Salford Electricity Committee has recommended to the Corporation that premises in Chapel Street be purchased at a cost of £1,332 for the purpose of an electrical showroom for domestic appliances.

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Callender's Band.—Callender's Cable & Construction Co.'s Works Band, which broadcast an excellent performance from 2LO on Friday last (Conducted by Mr. T. Morgan), has been established 25 years, and is confined to the company's employés at Belvedere, Kent. It competes regularly at the important contests arranged by the London and Home Counties Amateur Bands Association, to which it is affiliated. The selected pieces last Friday included the "Oliver Cromwell" overture, the Test Piece at the Crystal Palace Contest in September, 1924, when this band was awarded the coveted Grand Shield. Up to the outbreak of the great war the band had obtained 22 prizes at 26 contests. In 1924 a junior band of 40 was instituted, and the senior band was able to enrol specialists on certain solo instruments, with the result that the band now takes its place worthily among England's best. The band at present holds six trophies. Sir Tom Callender has been president of the band from its inception, and it owes much to his continued interest and assistance.

Aluminium and the German Commercial Treaty.—According to Article 10 of the Treaty of Commerce between Germany and England, which has not yet been ratified, it is provided that, as far as possible, trade and communication between the territories of the contracting parties, are not to be hampered by any kind of import or export vetoes or limitations. The production of aluminium in Germany is a monopoly of the State, and it is stated that during the course of the treaty negotiations with Great Britain, the German administration of the monopoly succeeded in securing the maintenance of the German import veto on crude aluminium which was issued during the war. The position with regard to the negotiations of the treaty of commerce between Germany and Switzerland has not been made clear officially. It is, however, assumed from the second clause of the above-mentioned article that Germany in maintaining the import veto with regard to Great Britain has also simultaneously undertaken to carry out this import veto in relation to other foreign countries.

Hungarian Tariff Increase.—Among the articles subject to increased import duties as from February 15th are galvanic batteries.

The German Electrical Industry.—At the annual meeting of the Siemens and Halske Company, held in Berlin, on February 26th, Herr Karl Friedrich von Siemens delivered a long speech, in the course of which he made pessimistic observations on the present general economic situation of the country, and predicted a possibly worse situation in the near future, particularly as the money now flowing into Germany would increase the passivity of the trading balance through the falling off of large payments for interest and redemption. Concerning the state of business in the electrical industry in particular, he mentioned that a slight improvement had recently taken place in the inland market, but the foreign business was greatly depressed. He said that the costs of production in Germany were mostly higher than the world market prices. Old and newly-created States, he complained, were surrounding themselves with high Customs walls for the protection of national industries, and owing to the lack of capital the Germans were forced to adopt selling conditions, particularly with regard to large installations, which drove customers to their foreign competitors. In conclusion, the chairman remarked that he was convinced that the German electrotechnical industry, which despite all difficulties had succeeded in keeping itself on a high level of technical progress, would be able to look forward to a favourable development if confidence at home and abroad could be restored through a systematic policy which kept the German future in view; but that, he added, was a problem the solution of which did not lie in German hands.

German Electrical Plant for France.—A private motion has been introduced into the Chamber of Deputies by M. Charles Baron and a large number of members (about 400 belonging to the socialist group or to the group for the defence of the peasants) proposing the immediate execution of a programme of works of electrification in the rural districts for which there should be utilised deliveries in kind to be obtained from Germany through the application of the protocol of London. It is stated that the whole question of the electrification of the rural regions is dominated by the financial side of the problem. In a recent report approved by the Chamber, M. Lamoureux explained the necessity for organising on a large scale the use of deliveries from Germany, and the urgency of taking advantage of these deliveries. The signatories of the resolution invite the Government as a matter of urgency to exercise its rights in the direction indicated.

Recent Vickers Contracts.—Among the recent contracts secured by Messrs. Vickers, Ltd., and their associated firms are those for the installation of a condensing plant in connection with the new 6,000-kW turbo-generator set at the Brighton electricity works; three 250-ft. long kiln shells for the Associated Portland Cement Manufacturers; and a condensing plant, &c., for the new 10,000-kW turbo set at the Poplar electricity works.

Extensions in Rumania.—The city of Timisoara, Transylvania, contemplates the extension of the municipal electricity supply undertaking. Details regarding the plant which is required may be obtained from the prefecture of the city, or from Dr. Adolf Erdös, Oradea Mare, Alexandri Street, Transylvania (to whom letters in English can be addressed). Tenders are to be opened on March 23rd.

Lead.—In last week's report on the lead market Messrs. James Forster & Co. stated that demand from home consumers was quiet. Supplies are well up to the average of the last three or four months. If they continue to come in on the same scale in March there seems nothing to prevent the price falling further still.

Cheap Electricity and Trade.—Mr. Felix J. Blakemore, ex-president of the National Chamber of Trade, in addressing a gathering of traders, at Blackburn, on February 26th, referred to the development of the application of electricity to industry which was taking place in the country. If that development could be carried out on the lines of electricity for all purposes, then home railways and industry in the city and in the town, would receive their power, heat and light at an average charge of ¼d. per kWh. This would enable them, whilst maintaining a high standard of living at home, to vastly reduce the prices of manufactured goods overseas, thereby increasing export trade and absorbing thousands of unemployed people. Cheap electricity for agriculture would mean greater production of foodstuffs, and a reduction in the general cost of living.

Electric Locomotives for Czecho-Slovakia.—*Reuter's Trade Service* reports that the Minister of Railways is shortly calling for tenders for a great deal of rolling stock, including 16 electric locomotives.

Meter Approved.—The Electricity Commissioners have approved of the construction and pattern of the meter known as the "Measurement" D.C. Mercury Motor A.H. Meter, Type "H.M.," rated sizes from and including 2.5 amps. to 150 amps.

Geneva Wireless Exhibition.—An International Wireless Exhibition is being held at Geneva from September 23rd to October 4th this year, and we have received an advance prospectus from the organising board (6, Boulevard du Théâtre, Geneva). From this we gather that the show will embrace, in addition to radio apparatus, kinematographic appliances, gramophones, scientific toys, and scientific appliances. The President of the Swiss Confederation and other prominent public men, including Sir Eric Drummond, Secretary-General of the League of Nations, are on the honorary committee of the exhibition. The prospectus contains the rates for space at the show.

Social Events.—The management of the Union Cable Company, Ltd., Dagenham Dock, entertained the whole of its staff, workpeople, and friends at a concert at St. Margaret's Hall, Barking, on February 21st. An excellent programme was provided. Mr. J. Snow Huddleston (general manager) presided, and made an interesting speech, which was replied to by Mr. H. G. Goodwin, who thanked the company on behalf of the employés.

The Social Society of the County of London Electric Supply Co., Ltd., held another of its successful dances on Saturday evening last, at Australia House, Strand. The dance eclipsed the previous one held at Cannon Street Hotel, and it was evident from the attendance that the choice of evening was more popular. The organisers wisely re-engaged Bert King's Syncopated Orchestra which, as usual, was in great form. Novelties were freely distributed, and not the least important improvement was the catering. The only apparent fault was that the end came all too soon. The secretary, Mr. W. Eccles Jones, and those who assisted him, are to be congratulated on the excellent arrangements made.

Last Monday evening the staff of the Electrical Supplies Company held a social and dance at the Mecca Café, Ludgate Hill, E.C. Mr. Wyld Smith acted as M.C.

The Edinburgh branch of the Electrical Contractors' Association of Scotland held its annual entertainment on February 26th, when 140 ladies and gentlemen enjoyed whist and dancing. Mr. J. J. Foggo, chairman of the branch, presided, and among those present were Mr. E. Seddon, chief electrical engineer of Edinburgh Corporation, Mr. Duncan, his assistant, and Mr. R. A. Ure, Glasgow, president of the Association.

The annual dinner of the male staff of W. T. Henley's Telegraph Works Co., Ltd., will take place at the Abercorn Rooms, Liverpool Street Hotel, on March 14th.

Football.—In the competition for the football cup presented by the Cable Makers' Association, Henley's and the Union Cable Co. met in the first round. It happened that neither team had a ground available, and the match was played on the ground of the Sterling Telephone Co.'s Football Club, which was kindly lent for the tie. Henley's and Union are old football rivals. They have met on many occasions, and Union have never defeated their opponents. History was repeated in the match under notice, the Henley team winning a fine sporting game by 5 goals to nil. After the match the players and spectators were provided with a meat tea by the Union Co., at which Mr. J. Snow Huddleston presided.

The Hackney Consumers' Directory.—In a recent issue we mentioned that the Hackney municipal electricity department had compiled a directory of its consumers. We have now received a copy of this from Mr. L. L. Robinson, the borough electrical engineer. It commences with full particulars of the scale of charges now in force and a statement of the conditions under which a supply is given. The directory proper is arranged according to streets; the particulars given in each individual case are the number of the premises, the occupier's name, the nature of the premises (private house, factory, shop, &c.), a description of the trade carried on (if

any), and the class of installation (lighting, heating, power, or cooking). As Hackney is a large borough and is well developed electrically, the directory represents the fruits of a great deal of labour. It will, of course, have only a limited circulation, and for this reason its price is fairly high (3 guineas in the first place, falling to 2 guineas after six months, and £1 10s. 6d. after a year), but we can well imagine that its usefulness to electrical contractors, retailers and others, will be out of all proportion to its cost.

A "Magnet" Selling Handbook.—We have received from the GENERAL ELECTRIC CO., LTD., a booklet entitled "Making a Market for 'Magnet'" by Mr. H. Clifford Palmer. This is a sales manual containing a number of useful suggestions for retailers of "Magnet" domestic appliances. Help is given in the composition of suitable letters to send to consumers; in the arrangement of window displays; in newspaper and other advertising and in many other directions. The publication is priced at 2s. 6d.

Electrical Exhibit at Warrington.—The Corporation Electricity Department exhibit at the recent Ideal Homes Exhibition held at the Empire Hall, Warrington, proved of particular interest and success. Domestic appliances were the main features of the display; cookers, water heaters, and radiators were shown and demonstrated. The accompanying

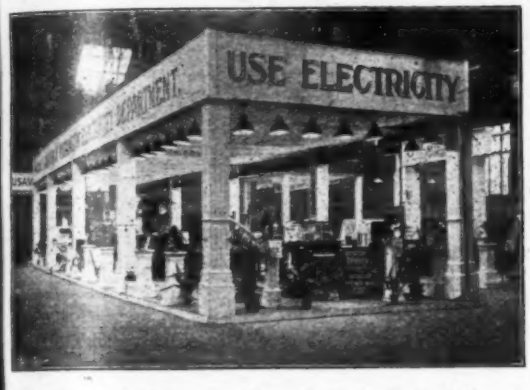


illustration will give some idea of the lay-out of the electrical stall. An exhibition of kinema films was given simultaneously at an adjacent hall, and the following films were shown; the list may be useful to others who desire to borrow films:—

(1) Electric Cookery: Preparation of a dinner (8 min.).
(2) The Power that Serves: Electricity in the Home (15 min.).
(3) Back of the Button: Changes made in the home by electricity (15 min.).
(4) Glasgow Electric House: Illustrating domestic applications.
(5) Electricity, the Key to Comfort in the Home.
(6) Coal Heap to Consumer: The History of Electricity.
(7) The Perfect Servant who Rules the World.
(8) An Electric Farm in Sussex.
(9) E.D.A. Exhibits at the British Empire Exhibition. (From the E.D.A.)
(10) Electric Lamp Manufacture (General Electric Co., Ltd.).
(11) An Englishman's Home (General Electric Co., Ltd.).
(12) A Steam Turbo-Alternator in the Making (C. A. Parsons and Co., Ltd.).
(13) The B.T.H. Works, Rugby.
(14) The Manufacture of a Turbo-Alternator.
(15) The Manufacture of a Mazda Lamp.
(16) The Manufacture of Fabroil Pinions.
(17) Electricity in an Iron Ore Mine.
(18) Electricity in Steel Works.
(19 The Story of Cotton.
(20) X-rays.
(From the British Thomson-Houston Co., Ltd., Rugby.)
(21) The Erection of H.T. Overhead Line.
(22) The Manufacture of Paper Insulated, Lead Covered and Armoured Power Cable.
(23) The Manufacture of Rubber Insulated Cable.
(24) Installation of H.T. Cable on Brighton Section of Southern Railway.
(25) Installation and jointing of dry core Trunk Main Telephone Cable (Tunbridge Wells-Eastbourne Cabling).
(26) Lights of Home.
(From Messrs. Johnson & Phillips, Ltd., Charlton, S.E.7.)

The exhibition was open for ten days, and the attendances at the cooking demonstrations and film show rose to as many as 800 on certain days.

British Empire Exhibition Notes.—The Exhibition management is allotting space in the Palaces of Industry and Engineering, and those who desire to exhibit this year and have not yet applied for space, should communicate by March 7th (to-morrow) with the Director of United Kingdom Exhibits, B.E.E., Wembley. The charges for space are based on 4s. 6d. per sq. ft. in the Palace of Industry and 3s. 6d. per sq. ft. in the Palace of Engineering.

MESSRS. J. LYONS & CO., LTD., have paid to the exhibition authorities £158,000 as an agreed percentage of their takings in respect of catering at Wembley last year.

Lighting and Power Notes.

Argentina.—ELECTRICITY SCHEME.—According to the *Review of the River Plate*, the Compañia Hispano Americana de Electricidad has presented to the technical officers of the Ministry of Public Works plans and estimates for the construction of a large power station which it proposes to erect on a site on the River Plate shore beyond the fourth basin of the New Port. This new power station is necessary to cope with the increased demand for electric energy in the Capital. The company expects to complete the station within two years of receiving the Government authorisation. The estimated cost is 50 million pesos paper.

Belgian Congo.—ELECTRICAL DEVELOPMENT.—It is reported that work on the establishment of the electricity station at Elisabethville has so far been completed that the Société Ccloniale d'Electricité has been able to commence a supply in part of the town. The same company has also the concession for the supply of electricity in the town of Kinshasa, where work on the erection of the generating station is making rapid progress.

Bedford.—ELECTRICITY CHARGES.—The Town Council has adopted the following new scale of electricity charges as from March 31st:—Power: Maximum charge of 2½d. per kWh, less 5 per cent., against the former price of 2½d.; domestic users, a flat rate of 1d. per kWh, instead of 1½d. for the first 250 kWh, 1¼d. for the next 500 kWh, and 1d. beyond. Lighting: 7d. per kWh, less ½d. discount, as against 7d. less 2½ per cent.

Birmingham.—LOAN SANCTIONED.—The Corporation has received sanction to loans of £190,000 for general mains extensions and £10,000 for a main transmission line.

Bootle.—SUPPLY TO SMALL HOUSES.—The Corporation proposes to equip houses built on a new housing site with electricity. The supply will be given by the Liverpool Corporation on the same terms as those for the supply to the Liverpool housing estates, subject to sanction being received to a loan.

Brecon.—ELECTRICITY SCHEME.—The Town Council is applying for a Special Order to supply electricity in the borough. It is estimated that the proposed scheme will cost from £15,000 to £16,000.

Clitheroe.—SPECIAL ORDER.—The Corporation is applying for a Special Order authorising it to supply electricity in the borough and in certain parishes in the rural district.

Conway.—SPECIAL ORDER.—The Corporation has applied for a Special Order authorising it to supply electricity in parts of certain parishes in the rural district.

Dover.—LOAN SANCTIONED.—The Town Clerk has reported that sanction has been received to the borrowing of £1,500, in connection with the installation of a mercury vapour rectifier in the sub-station to be provided in the Pier district.

Dudley.—STREET LIGHTING.— The Lighting Committee has recommended that an agreement be entered into with the Shropshire, Worcestershire and Staffordshire Electric Power Co. for the lighting by electricity of the main streets in the borough for a period of seven years from March 31st next on the following terms:—13 lamps of 1,000 candle-power each, £174; 141 lamps of 400 candle power each, £1,077. The company has also agreed to light secondary streets in the borough, if required, during the period of the agreement, with 150 candle-power lamps at a cost of £6 per lamp per annum.

Eastbourne.—NEW SUB-STATION.—The Electricity Committee proposes to erect a new sub-station at a cost of £7,501.

Eccles.—YEAR'S WORKING.—The accounts of the Corporation electricity undertaking (engineer, Mr. H. W. Angus) for the year ended March 31st, 1924, record a total revenue of £38,101, as compared with £38,711 in the preceding year. The working expenditure amounted to £26,374, as against £28,742, and the gross profit was thus £11,726 (£10,239). The capital charges absorbed £7,247, leaving a net surplus of £4,480, as compared with £2,658 in 1922-23. Of this amount £600 has been set aside for the purchase of electric cookers. The capital expenditure during the year amounted to £13,538, the main items being £5,673 for transformers and £3,017 for mains.

Greenock.—STREET LIGHTING.—At a recent meeting of the Corporation, the claims of gas and electricity for the street lighting in one of the new housing areas were considered. It was agreed that the lighting should be done electrically by 48 lamps of 300 c.p. each. It was also decided to continue the electric lighting of Greenock's main thoroughfare eastwards to the Port Glasgow boundary, and to replace the existing gas lamps by 24 electric lamps of 2,000 c.p. each. The Electricity Department is preparing further schemes for improved lighting in the district and a proposal is being put before the Port Glasgow Town Council Lighting Committee for electrically lighting the main thoroughfare of Port Glasgow.

Hornsey.—MAINS EXTENSIONS.—A new main is to be laid from the Council's generating station to the Highgate sub-station in North Road at a cost of £12,000.

Huddersfield.—INTER-CONNECTION SCHEME.—The Corporation has instructed the Town Clerk to arrange a conference between representatives of Huddersfield and Halifax Corporations, and the Electricity Commissioners, to discuss the question of linking up the Huddersfield and Halifax electricity undertakings.

Irish Free State.—SHANNON POWER SCHEME.—Mr. P. McGilligan, Irish Free State Minister of Industry and Commerce, speaking at Ballinlough recently, said that the report of the experts on the scheme for the harnessing of the River Shannon had been so satisfactory that the Government had had no hesitation in deciding to proceed with the scheme. From the financial point of view, the scheme had passed all the tests. From the economic standpoint it would put them in possession of an ample, cheap supply of electricity. Within three years, he predicted, revivifying electrical power would be pouring through the industrial veins of Ireland, north, south, east, and west. They had taken no notice of attempts to disparage the scheme; undue eagerness to condemn it before particulars were available was not consistent with the open minds and the unbiased judgment with which a proposal of such national importance deserved to be considered.

£10,000,000 LOAN.—Our Dublin correspondent states that all details of the Shannon scheme are now ready, and will be embodied in a Bill to be laid before the Free State Parliament within a few weeks. It is practically certain that a loan will be sought, and that this will be readily obtainable. The figure named is £10,000,000, though some years must necessarily elapse before so much money could be absorbed in the work. It would not be surprising, however, if the loan were not sought until the work was well advanced—say a year from now—or it might be deemed wise to raise the money by instalments.

A new body will probably be set up to supervise the work, the Board of Works staff being scarcely adequate to undertake the task. The effect of the adoption of the Shannon scheme on the three rival schemes for the harnessing of the River Liffey is being watched with interest, as, recently, Mr. McGilligan stated that the Government would offer all the opposition it could to these schemes, the official view being that the Shannon scheme could provide sufficient power for the whole of the Free State; that it should not be retarded by lesser schemes, and that the generation of power from one great centre would be more economical than if two or three centres were involved. The matter is further dealt with in our leading and "Notes" columns.

Lancashire.—ELECTRICITY SUPPLY.—Representatives of the Blackpool, Lytham-St. Annes, and Fleetwood Councils have been in consultation for some time with a view to arriving at a basis of settlement regarding a scheme of electricity supply for the Fylde coastal towns from the new power station on the Ribble at Preston. The Joint Committee has now come to an agreement, and this has been forwarded to the authorities concerned. The three Councils will be recommended to accept the scheme.

Leicester.—ELECTRICITY EXTENSIONS.—The Electricity Committee has recommended to the City Council that the following extensions be carried out:—Extension of East Park Road sub-station, £1,189; rotary converter for this sub-station, £4,429; one 500 kW rotary converter for the Aylestone generating station, £3,200.

Llandudno.—LOAN.—The Town Council is applying for sanction to a loan of £5,000 for electricity extensions.

London.—BATTERSEA.—The Electricity Committee proposes to carry out the following schemes:—Extensions of buildings and plant at the generating station: generating plant, £64,000, steam-raising plant, £70,000; and provision of new mains, &c., in central district, £21,500.

The Housing Committee has recommended that electric cooking and heating apparatus be provided in tenements to be erected in connection with the Council's housing scheme. The proposed charge to tenants is 1s. per week and 1d. per kWh for electricity used.

HACKNEY.—The Electricity Committee has recommended to the Borough Council the purchase of land in Gainsborough Road at a cost of £3,000 for a sub-station.

STOKE NEWINGTON.—The Borough Council has decided to provide slot meters in houses in which consumers have installed the wiring, where required by a consumer, at an additional charge for electricity supplied of 1½d. per kWh, subject to a minimum consumption of 150 kWh per annum.

POPLAR.—The Borough Council is applying for sanction to borrow £30,000 for electricity purposes.

Luton.—EXTENSION OF SUPPLY.—The electrical engineer has reported to the Electricity Committee that the estimated cost of supplying electricity to part of Stopsley and to Leagrave is £3,127, and the Committee has instructed him to proceed with the scheme as soon as the Special Order to supply in the areas is received.

Manchester.—PROGRESS DURING JANUARY.—During January the new connections to the mains of the Electricity Department equalled 1,285 kW, bringing the total to 244,829 kW. In addition, applications were received in respect of a further 2,085 kWh. The number of cookers actually on circuit rose from 575 to 611.

Millom.—ELECTRICITY SCHEME.—The Urban District Council has received from the Millom & Askam Hematite Iron Co. terms for a supply of electricity. The Council has replied proposing more favourable terms.

New Zealand.—HYDRO-ELECTRIC DEVELOPMENT.—It is reported that a company has been formed to utilise the Bowen Falls at Milford Sound for generating electricity.

North Berwick.—PURCHASE OF UNDERTAKING.—The Town Council proposes to exercise its option to purchase the undertaking of the North Berwick and District Electric Light and Power Co., Ltd., and has made an offer of £10,500.

Nottingham.—ELECTRICITY SCHEME.—In connection with the Corporation's scheme for the erection of a new power station at North Wilford, it was originally intended to install three 10,000-kW sets, but in view of the abnormal demand for electricity during the past year, and as certain outer districts have been included in the Corporation's area of supply, Mr. J. H. Rider, consulting engineer to the Corporation, has recommended that the capacity of the plant be increased to 50,000 kW by the addition of a 20,000-kW turbo-alternator, with two boilers and other auxiliary plant. The estimated cost of the extension is £292,000, making a total for the whole scheme of £977,000. The Electricity Committee has recommended that the installation of the additional plant be approved, and that application be made for sanction to a further loan to meet the cost. As we reported in a recent issue, the station will be inaugurated on September 24th next.

Oldham.—PROPOSED CHANGE-OVER.—The Corporation has given notice of its intention to apply to the Electricity Commissioners for sanction to change its system of electricity supply from 3-wire d.c. at 420 and 210 V to 4-wire a.c., 3-phase, 50 periods at 400 V and 230 V.

Plymouth.—NEW PLANT.—The Electricity and Street Lighting Committee has decided to install an additional 1,500-kW converter at the Newport Street station, where the winter load has reached the station's full capacity. In order to provide the necessary space an obsolete converter is to be removed. Application is to be made for a loan of £10,450 to cover the cost of the work.

Portmadoc.—ELECTRICITY SCHEME.—The question of an electricity supply for Portmadoc has been further considered by the Town Council, which has now approved of a modified scheme at an estimated cost of £15,226, allocated as follows:—£9,497 to Portmadoc, £3,167 to Borth-y-Gest, £2,562 to Tremadoc. The scheme has been submitted to the Electricity Commissioners in opposition to the one presented by the Gwynedd Trust and the Council proposes, if it is approved, to carry it into effect by instalments.

Preston.—STREET LIGHTING.—The Town Council has decided to make the necessary arrangements to light the streets with electricity.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

COVENTRY.—Lighting: From 5d. to 4½d. per kWh (through prepayment meters, from 6d. to 5d.). Power and heating: From 1½d. to 1¼d. per kWh.

KENILWORTH.—*The Midland Electric Light & Power Co., Ltd.*—Lighting: From 8½d. to 8d. per kWh.

PLYMOUTH.—Lighting: From 5d. to 4½d. per kWh, with corresponding reductions to power and other consumers.

POPLAR.—The percentage increase reduced from 50 to 40 per cent., except for power under separate agreement, and the fixed charge on the domestic contract system.

EASTBOURNE.—Lighting: Flat rate from 5d. to 4½d. per kWh. An alternative multi-part tariff for both domestic and business premises at the rate of £10 per kW per annum, plus 1d. per kWh. Power: From sliding scale of 2½d. to 1d. per kWh to flat rate of 1d. per kWh. Heating and cooking: From 1½d. to 1d. per kWh.

ILFORD.—Rateable value system: Electricity consumed for any domestic purpose, a charge of 12½ per cent. of the rateable value, plus ½d. per kWh. Lighting: Flat rate, 4½d. per kWh. For 10,000 kWh and over per quarter, 4d. per kWh. Maximum demand rate: For the equivalent of one hour's use of maximum demand per day, 7d. per kWh; all energy in excess of this amount, 1½d. per kWh.

BLACKPOOL.—The percentage increase on pre-war charges has been abolished.

REIGATE.—Lighting: From 8d. to 7d. per kWh.

Tanfield.—SPECIAL ORDER.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising the Urban District Council to supply electricity in the district.

Taunton.—SPECIAL ORDER.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation a Special Order authorising the Corporation to supply electricity in part of the rural district.

United States.—HYDRO-ELECTRIC DEVELOPMENT.—The Remmel Dam plant on the Ouachita River was set in operation by the Arkansas Light and Power Co. recently. It will be connected with a 100,000-h.p. steam power station now under construction by the Louisiana Power Co., near Monroe, La., and with the system of the Mississippi Power and Light Co. serving 25 cities in Mississippi. The new plant will ulti-

mately develop 24,000 h.p., and represents an expenditure of £1,600,000. The Remmel hydro-electric plant is the first of three stations to be constructed by the company on the Ouachita River for the development of 125,000 h.p.—*Power.*

Uruguay.—MONTEVIDEO.—The Board of the State power houses has appointed a technical committee to prepare the plans for a new power station in Montevideo. The new station is to be built in the locality known as Arroyo Seco. The capacity of the station now in service is 30,000 kW, and the new establishment would raise the capacity to 50,000 kW.—*Review of the River Plate.*

West Kirby.—LOAN.—The Urban District Council has applied for sanction to a loan of £1,600 for extensions to the electricity works.

Wrexham.—ELECTRICITY CHARGES.—The Town Council has fixed the following new scale of charges for electricity as from April 1st next:—Lighting: 6½d. per kWh up to 500 kWh per quarter, next 500 kWh 6d., next 1,000 kWh 5d., beyond 2½d. Alternative rate for lighting, heating, and other domestic purposes: 20 per cent of the rateable value, plus 1d. per kWh. Shops and other business premises consuming over 500 kWh during the summer quarters and 1,000 kWh during the winter quarters, a fixed rental of 2s. 6d. per summer quarter and 6s. per winter quarter per 100-watt lamp installed, plus 2½d. per kWh. Heating and cooking: Flat rate of 1½d. per kWh. Power: 3d. per kWh up to 500 kWh per quarter, next 500 kWh 2½d., beyond 2d. All charges subject to a discount of 2½ per cent. for prompt payment of accounts.

Tramway and Railway Notes.

Australia.—TASMANIA.—The Government has received an offer from an English firm for the electrification of the Tasmanian railways.—*Reuter* (Hobart).

Bolton.—OPPOSITION TO BILL.—The Corporation contemplates schemes costing £1,500,000 in the Bill now being promoted in Parliament. Opposition is being made by local authorities to a clause providing for omnibuses and railless cars outside the borough. Power to run railless cars is confined, for the time being, to streets already served by the Corporation tramways. The expenditure provided for in the Bill for the provision of motor-omnibuses is £30,000.

Brighton.—SCHEME ABANDONED.—The Town Council has reversed its decision to extend its tramway system to Moulscombe.

Continental.—SPAIN.—An electric tramway, 13 miles in length, was inaugurated on February 21st, between Granada and the Sierra Nevada.—*Times.*

POLAND.—A *Reuter* message from Warsaw states that the construction has begun of a network of long-distance tramways which will link up all important points in the Polish coal-mining district. The lines are being constructed by an Anglo-Polish company, with the aid of British capital, and mainly with machinery imported from Great Britain. The system will be opened early in 1926.

Croydon.—NEW PLANT.—In connection with the proposed through running over the L.C.C. tramway system, the Tramways Committee has recommended the purchase of the following new plant:—E.h.p. feeder, £1,600; switchgear, £250; cables, £1,000; sub-station buildings, complete with cranes, foundations, £3,000.

India.—RAILWAY ELECTRIFICATION.—Our Indian correspondent reports that, in addition to the large G. I. P. railway schemes of railway electrification, a part of which was recently completed, the Government of India has under consideration the electrification of (1) the Calcutta suburban lines of the East Indian and Eastern Bengal railways, and the lines from Bengal and Behar and the Orissa coalfields to the port of Calcutta; (2) South Indian Railway, Madras to Tambaram. The Calcutta proposals include also the building of a bridge at Bally for the E.I.R., giving it a direct access to the new central railway station near Dalhousie Square when it is completed.

Leeds.—NEW CARS.—The Special Sub-Committee on Rolling Stock which was appointed by the Corporation to make investigations and to visit other towns with a view to ascertain the best means of street transport, has submitted a report to the Tramways Committee in favour of the continuance of the present tramway system and recommending that 260 of the oldest cars in service be replaced by 250 new cars of improved type and additional carrying capacity. The Tramways Committee has adopted the report and resolved that specifications be prepared and tenders invited for 150 new cars and that authority be given for building a further 50 new cars on the same specification in the works of the department.

London.—MORDEN LINE.—In connection with the extension of the City Railway from Clapham Common to North Morden, the Underground Company has placed a contract with the Foundation Company for the construction of the southern section of the line between Dorset Road (Clapham) and North Morden. The total length of the new extension is five miles, and it is estimated that 50,000,000 passengers will be carried by it annually. There will be seven stations, all of which, with the exception of North Morden, will be equipped with escalators. The northern section between Clapham Common and Dorset Road is now under construction, over three miles of single tunnel having already been completed. The total cost of the completed railway is estimated at £3,500,000.

L.C.C. SUB-STATIONS. — The Highways Committee of the L.C.C. has recommended that two rotary converters be obtained, one for Hammersmith sub-station and the other for another sub-station, probably New Cross. It is also proposed to reconstruct the h.p. switchgear in the Shoreditch and New Cross sub-stations. The cost of the improvements is estimated at £20,000. The works transformers at the Greenwich power station, which are used for the supply of lighting and power to auxiliary plant, are subject to continual overloads, and the Committee has recommended that additional transformers, with the necessary switchgear, be provided at an estimated cost of £5,000.

United States.—RAILWAY ELECTRIFICATION.—According to the *Electrical World*, the Maine Central Railroad is to investigate the cost and feasibility of electrifying its main line from Portland to Bangor.

Telegraph and Telephone Notes.

Automatic P.B. Exchange.—BATTERSEA.—The Borough Council has given directions for the Relay automatic telephone system to be installed throughout the Council's buildings at an estimated additional cost of £100 per annum.

Germany.—TELEPHONY ON TRAINS.—Within the next two or three months the first through service of trains fitted with telephones will run between Berlin and Hamburg; the trials of the apparatus have been completed. It is also intended later in the year to install telephones in trains travelling on other main lines, such as Berlin-Munich, Berlin-Stuttgart, Berlin-Frankfort, and Berlin-Hanover, says the *Daily Telegraph.*

Passengers travelling on the through trains between Berlin and Hamburg will be able to get into direct telephonic communication with subscribers in any part of Germany. They can also be called on the train telephone by other subscribers. In addition, telephonic communication can be established between passengers travelling on different trains. The installation is in the hands of a private company, the Railway Telephone Co.

India.—"BEAM" RADIO TELEGRAPH STATION.—The contract that the Indian Radio Telegraph Co., which is directed by a board of prominent Indian business men and has close links with the Marconi Co., lately entered into for the establishment of a "beam" radio-telegraph station in India, imposes on the company the obligation to train Indian apprentices and employ Indians as far as possible, and it provides that 60 per cent. of any increase of capital determined on shall be offered for public subscription in India.

Norway.—NEW RADIO-TELEGRAPH STATION.—The large new radio-telegraph receiving station which has been erected by the Norwegian Government at Fornebo has reached completion. Preliminary tests conducted prior to the station being taken over by the Telegraph Department gave the utmost satisfaction, communications being received with great clarity from Buenos Aires, Honolulu, Tananarivo, Saigon, and other far distant stations. The Fornebo station has been designed to handle the incoming traffic which up to now has been dealt with by the Stavanger station. It has been constructed by the Societe Francaise Radiotelegraphique at a cost of about 150,000 kroner. The steel lattice masts are 250 ft. high.—*Reuter* (Oslo).

Radio at Sea.—LINER'S RECORD.—The use of radio-telegraphy between ships and shore continues to grow. The White Star liner *Majestic* received and sent over 35,000 messages, totalling 750,000 words, during 1924, equal to 3½ words per minute throughout each voyage, a considerable increase on her record for the previous year.

Radio Telegraphy.—POST OFFICE CONTROL.—The *Evening News* learns that the General Post Office authorities have decided not to create a special department to deal solely with the development of the radio telegraph and telephone services, as advocated by the Committee on Organisation and Imperial Wireless Services, which considered the matter last year. The future of "wireless" will be in the hands of the present G.P.O. officials. Those responsible for the administration are the Secretary of the G.P.O., the Director of Electrical Communications; the Assistant Secretary of Telephones; the Assistant-Secretary of Inland Telegraphs; and the Assistant-Secretary for Overseas Telegraphs. The principal wireless engineer is to be raised to the status of assistant engineer-in-chief, and the engineering department of the G.P.O. will control and staff wireless

stations. It is also proposed to form an Advisory Committee, with nominees of the Dominion Governments, to make recommendations on hours of working, tariff charges, and general cable and radio matters.

Radio Telephony.—Transatlantic Tests.—Clear two-way speech with the United States has taken place during recent radio-telephony experiments at the Post Office 200-kilowatt plant at Rugby. In the opinion of Post Office engineers, says the *Daily Mail*, within a year London subscribers will be able to speak to New York. Procedure in Transatlantic conversations will be the same as for a trunk call. When the number has been given, the subscriber will hang up his receiver, and when a clear line through from the New York exchange to the American subscriber has been established he will be called and will then be in direct communication. The apparatus has been made by the Western Electric Co., Ltd., and will be tested by the company for several months before it is handed over to the P.O. authorities.

The Telephone Service.—London Development.—Mr. H. Dine, of the London Telephone Service, is reported by *The Times* to have explained in a recent speech that the London telephone service was developing rapidly. In the last six years the number of direct exchange lines had grown by 100,000, while the number of actual telephone points had grown from 260,000 to 425,724. The first automatic exchange in London, the Holborn, would be opened in 1926, and in the same year the Tandem exchange, a junction centre exchange, would be opened. Every one knew the improvement which had been effected by the Toll exchange, and on the same principle the Tandem exchange would deal with calls between all exchanges in the London automatic area and enable all automatic telephones to get into communication with any part of London. In 1927 they hoped to open four additional automatic exchanges and a new Toll exchange which would cover all districts within 60 miles of London. In 1914 there were 605 inland trunk circuits running direct from London, and 13 to the Continent. Now there were 1,795 inland circuits running from London and 34 to the Continent. The telephone service to France had been triplicated, as also had that to Belgium, and there was now as large a service to Holland as to Belgium. They hoped soon to get good conversations with Germany through Belgium and with Switzerland through France. It was the dream of the Post Office to get good commercial conversation between London and New York. That was a realisable dream.

West Indies.—Week-end Letter Service.—The Western Union Telegraph Co. and also Marconi's Wireless Telegraph Co. announce that, in addition to the existing week-end letter facilities, a similar service has now been arranged to all the principal islands in the British West Indies.

The Postmaster-General announces that a week-end letter telegram service to the British West Indies and British Guiana has been instituted *via* the Imperial cables; a corresponding service is now available *via* Imperial to Bermuda, Turk's Island, and Jamaica.

Radio Notes.

Council Debates.—Not to be Broadcast.—The Birmingham City Council has followed the example of Swansea by deciding not to permit the broadcasting of debates from the Council Chamber, to do which permission had been sought recently by the B.B.C.

India.—Broadcasting Possibilities.—The possibilities of broadcasting in India are great and varied and *The Times Trade and Engineering Supplement* points out that the position calls for the watchful attention of manufacturers. The Government has not yet formulated a policy and at present there is little more than a rudimentary beginning. Radio clubs in Calcutta, Bombay, Madras, and Karachi are licensed to broadcast entertainment programmes and news. The stations are very small, and practically only serve the cities in which they are situated. In addition, a fair number of amateurs and experimenters have been licensed, but there is no organisation for the dissemination of meteorological or commercial news, or of addresses of educative and general interest. Certain ruling princes are alive to the possibilities and have installed radio sets in their States.

The smallness of the trade is shown by the fact that the imports of "wireless" apparatus of all kinds in the last complete fiscal year reached a value of less than Rs. 1½ lacs, or £100,000 at the 1s. 4d. rate of exchange. It is satisfactory that the United Kingdom provided more than nine-tenths of the shipments. The proportion is being maintained with the increasing demand of the present fiscal year. In August, September, and October last, the total value of the shipments was over a lac of rupees, or two-thirds of the total of 1923-24. The quotas contributed by Germany, Belgium, France, and the United States, taken together, were almost negligible in comparison with the United Kingdom contribution. "Wireless" apparatus is liable to a duty of only 2½ per cent., as compared with the general rate of 15 per cent. which applies to electrical gear.

The tentative view communicated last summer by the Government of India to the local Governments was that licences to broadcast should be granted only to persons approved by the local Government in the Province in which the broadcasting system is to be established, and that the licence should be for the service of prescribed areas.

It is to be hoped that a satisfactory service may be established without prolonged delay, but it is not likely to become as popular in India as in this country, because the means of the educated middle classes are, for the most part, very limited; nor have they as a rule much aptitude for the use of electrical apparatus.

Licences.—Augmented Demand.—Whatever may be the ultimate result of the Postmaster-General's Wireless Telegraphy and Signalling Bill, the publicity given to his drastic proposals had a very salutary effect upon "pirates," whose number has been estimated at upwards of a million. For instance, within four days of the first intimation of the Postmaster-General's intentions, approximately two thousand people had taken out licences in the Birmingham Post Office area alone—an income of £1,000. The rush necessitated an augmentation of the staff in the licence department at the Birmingham head Post Office. Even at normal times fourteen clerks are kept busy dealing with licences, and an enormous amount of work is entailed in sending out second and third applications for renewals of licence fees; in cases where no response is forthcoming and it is known that a set is being used, particulars are sent to the head office at London so that in the event of the new proposals becoming law action can be taken forthwith.

Bogus Inspectors.—It is reported that a man and a woman, pretending to be B.B.C. inspectors of radio receiving licences, have been calling at houses in Hull and collecting fees from people who have not yet taken out licences on threats of prosecution.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared in our advertisement pages.)*

Open.

Aberdare.—March 31st. Urban District Council. Overhead and underground l.p. distributing mains and underground h.p. and l.p. feeders; public lighting; sub-station building, plant and equipment. (February 27th.)

Adwick-le-Street.—April 6th. Urban District Council. Sub-station equipment, h.p. and l.p. joint boxes and cables, distribution pillars, &c. (See this issue.)

Australia.—Sydney.—April 2nd. Postmaster-General's Department. Accumulator batteries and parts.*

Melbourne.—April 1st. Victorian Government Railways. One 15-ton electric travelling crane.*

May 4th. 15 potential transformers.*

Bedford.—March 25th. Electricity Department. E.h.p., h.p. and l.p. cables for 12 months. See this issue.)

Belgium.—March 18th. Belgian Post and Telegraph authorities, La Salle Madeleine, Brussels. Telegraph and telephone material. Particulars (Cahier des Charges Special, No. 3-93) for 3 fr. 65 c.

Antwerp.—April 16th. Port Authority. Thirty electrically-operated portal cranes (3-metric tons capacity).*

Bilston.—March 26th. Urban District Council. Pumping station at Wombourn, Staffs., of two pumping units, complete with crane tanks, electric lighting plant, &c. Specification (£5) from Mr. J. L. Arlidge, clerk to the Council, Town Hall, Bilston.

Bridlington.—March 16th. Electricity Department. Stores for 12 months, including electric lamps, lampholders, conduit, fittings, switches, cable, &c. (February 27th.)

Bristol.—March 10th. Board of Guardians. Electrical fittings for six months. Mr. T. S. Lamb, clerk, St. Peter's Hospital.

Denmark.—Copenhagen.—March 10th. Lighting Department. Rotary converters.*

March 17th. Transformers.*

Dublin.—Board of Works. Electric lighting installation at the Civic Guard Depôt, Phœnix Park, Dublin. Mr. J. J. Healy, secretary, Board of Works, Dublin.

Edinburgh.—March 9th. Electricity Supply Department. E.h.p. switchgear and 3-phase transformers. (February 20th.)

Egypt.—Cairo.—April 30th. General Manager, Egyptian State Railways, Telegraphs and Telephones, Cairo Station. Supply and erection of a manual c.b. telephone exchange for 6,000 subscribers' lines, with an ultimate capacity of 8,000 lines, also 3,000 table and 700 wall telephones, with 3-position switches and private branch exchanges, subscribers' telephones, &c. Copy of the specification (L.E. 5) from Stores Department, Saptia (Cairo) or Gabbary (Alexandria), also at the Office of the Administration's Inspecting Engineer, Queen Anne's Chambers, S.W.1.—*Reuter's Trade Service* (Cairo).

Greece.—April 15th. Greek Government. Manual telephone exchange for the city of Athens.*

Hornsey.—March 26th. Electricity Department. One cooling tower. (See this issue.)

Ilford.—March 24th. Electricity Department. E.h.p. switchgear and ten 25-kVA transformers.

Ilkley.—March 11th. Electricity Department. Street lamp standards and bracket arms, lanterns, automatic time switches, and cable. (February 27th.)

India.—March 17th. India Store Department. Electric generating sets and switchboards. (February 20th.)

Kirkwall.—March 14th. Trustees of the Thoms Bequest. Electrical installation at St. Magnus Cathedral, Kirkwall. Schedules from Mr. James A. Liddle, Pentland Engineering Works, Robb's Lane, Gorgie, Edinburgh.

London.—HOLBORN.—March 11th. Board of Guardians. Electrical fittings for six months. Mr. C. J. Cross, clerk, 53, Clerkenwell Road, E.C.1.

ISLINGTON.—March 10th. Board of Guardians. Electrical supplies for six months. Mr. A. King, clerk, Guardians' offices, St. John's Road, Upper Holloway, N.19.

METROPOLITAN ASYLUMS BOARD.—March 25th. Installation of 144-tube economiser and new continuous drying machine, engineering work for new central boiler house, revision of laundry engineering arrangements, installing electric light and power wiring in boiler house and laundry, covering boilers, steam feed and suction mains, &c., at the South Western Fever Hospital, Stockwell. (February 27th.)

March 25th. Extensions to the electric lighting installation at the North-Western Ambulance Station, Lawn Road, N.W. (See this issue.)

Maesteg.—March 10th. Urban District Council. Installation of electric lighting at the Council offices, Town Hall, and markets. (February 27th.)

Middlesbrough.—March 13th. Visiting Committee. Electrical wiring of the Cleveland Mental Hospital. (See this issue.)

Pentre.—March 28th. Rhondda Urban District Council. 12 months' supply of a.c. house meters, cables, joint boxes, &c. (See this issue.)

Portsmouth.—March 18th. Board of Guardians. Three months' supply of electrical stores and lamps. Forms of tender from the Guardians' Offices, St. Michael's Road, Portsmouth.

South Africa.—March 16th. South African Railways and Harbours. Machine tools, motors, &c.*

CAPE TOWN.—March 24th. City Council. Special street-lighting fittings.*

April 7th. Disconnecting boxes.*

Nine transformers.*

JOHANNESBURG.—April 20th. Electricity Supply Commission, Union of South Africa. Hydro-electric power station at Sabie, Eastern Transvaal.*

Municipal Council. March 26th. 1,080-kVA single-phase transformers.*

LADYSMITH.—April 2nd. Municipal Council. Material for converting d.c. to a.c. supply for lighting and power.*

South Shields.—March 17th. Electricity Department. Steam, feed-water and blow-down piping, &c. (See this issue.)

Stoke-on-Trent.—March 10th. Electricity Department. 12 months' supply of mains and cables, a.c. and d.c. meters, sub-station switchgear and static transformers. (February 20th.)

Steam piping with welded flanges, valves, and steam traps, water pipes, valves, &c. (February 27th.)

Wrexham.—Electricity Department. Electric lighting of 56 houses on Acton estate. Specification from borough electrical engineer, Willow Road.

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Belgium.—The Belgian Post and Telegraph authorities in Brussels have just divided some large contracts for miscellaneous telephone material between the New Antwerp Telephone and Electrical Works Co., the Bell Telephone Manufacturing Co., Antwerp, and the Société Electricité et Mécanique, Brussels.

There was unusually keen international competition the other day for a small contract of 5½ kilometres of l.p. armoured cable for the municipal authorities of Schaerbeek, Brussels. Tenders were received from manufacturers in Belgium, Holland, Switzerland, Czecho-Slovakia, Germany, Denmark, and Great Britain, the last emanating from Callender's Cable & Construction Co., Ltd., and the British Insulated & Helsby Cables, Ltd. The offers showed considerable variation, the lowest being that of the Société des Cableries et Corderies du Hainaut, of Dour.

Bradford.—Town Council. Accepted:—
Automatic sub-station plant for sub-stations at Four Lane Ends, Thornbury, and Odsal.—A. Reyrolle & Co., Ltd.; Bruce Peebles & Co., Ltd.; and Metropolitan-Vickers Electrical Co., Ltd.

Carlisle.—In our issue of February 20th, p. 303, it was incorrectly stated that the Electricity Committee had placed its contract for deaerating and evaporating plant with Messrs. Mirrlees, Bickerton & Day. The contract was secured by the Mirrlees Watson Co., Ltd., of Glasgow.

Cheltenham.—Corporation. Accepted:—
Electric light fittings.—General Electric Co., Ltd.

China.—It is announced from Geneva that the Sulzer Co. has just secured an order for a further 3,600-h.p. Diesel engine for the central electricity station of the Compagnie des Tramways et d'Eclairage Electrique de Shanghai.

Croydon.—Corporation. Accepted:—
Coal-conveying plant at the generating station (£5,635).—Mitchell Conveyor Co.

Darwen.—Town Council. Accepted:—
Tramcar (£1,485).—Brush Electrical Engineering Co., Ltd.
Equipment (£923).—British Thomson-Houston Co., Ltd.

Hornsey.—Electricity Supply Committee. Accepted:—
Two water-tube boilers in place of the three existing boilers (£13,610).—Babcock & Wilcox, Ltd.

Hull.—Electricity Works. Accepted:—
One air preheater for the Woodeson boiler.—Howden-Ljungström Preheaters (Land), Ltd.

Ilford.—Tramways Committee. Recommended:—
Rails (£10 per ton), fishplates (£13 per ton). Total amount, £1,033.—Bolckow, Vaughan & Co., Ltd.

Electricity Committee. Recommended:—
1,000-kW La Cour motor converter (£3,000).—Ateliers de Constructions Electriques de Charleroi.
500-kW rotary converter and switchgear (£1,697 and £229).—Crompton and Co., Ltd.
L.p. cable: Enfield Cable Works, Ltd., single cables, £1,731; Pirelli-General Cable Works, Ltd., 3-core cables, £909; Macintosh Cable Co., Ltd., 2-core cables, £427.
E.h.p. cables (6,600 volts) (£5,375).—Hackbridge Cable Co., Ltd.
Renewal of battery for 5-ton coal wagon (£230).—Fuller's United Electric Works Co., Ltd.

London.—Metro-Vick Supplies, Ltd., is supplying Cosmos electric lamps to the London Electric Railway, London General Omnibus Co., London & North-Eastern Railway Co., the Southern Railway Co., and the Admiralty.

POPLAR.—The Electricity Committee recommends that orders be placed with Messrs. Vickers & International Combustion Engineering, Ltd., in accordance with their contract, for the following plant, to be provided as per specification, *viz.*:—
Overhead travelling crane (£2,700).—Babcock & Wilcox, Ltd.
Forced and induced fan piping (£1,180).—Vickers & International Combustion Engineering, Ltd.
E.h.p. switchgear (£12,945).—Provisional.
Inter-connecting feeders and trenching (£9,203).—Provisional and Vickers and International Combustion Engineering, Ltd.
Oil-filtering apparatus and air compressor (£597).—Jeffcock, Parsons, Alley & MacLellan.
Feed-water treatment (£2,060).—Vickers, Ltd.
Motors for coal handling and circulating pumps (£2,525).
Atmospheric exhaust pipe (£140); clearing site (£845).—Vickers and International Combustion Engineering, Ltd.

LONDON COUNTY COUNCIL.—Education Committee. Accepted:—
Electric lighting at the Raywood Street school, Battersea (£550).—Commercial Telephone and Electrical Co., Ltd.

SOUTHERN RAILWAY. Accepted:—
54 h.p. switchgear kiosks and transformers.—Park Royal Engineering Co., Ltd.

BERMONDSEY.—Baths Committee. Electrical installation at the new baths.—With further reference to the note on p. 338, ELEC. REV., February 27th, "Contracts Closed," the recommendation of the Committee having been referred back by the Council at its last meeting, the Committee has further considered the tenders for the installation, and has received a report from Mr. L. Gaster, technical adviser to the Council on illumination. He has interviewed the three firms who submitted the lowest tenders, and recommends the acceptance of that of Messrs. J. O. Grant & Taylor at £823 for the work required; the Committee now recommends the Council to accept this tender.

CAMBERWELL.—Borough Council. Recommended:—
Maintenance of electric lighting, heating, and power installations, private telephones and electric bells for all the buildings of the Borough Council.—Commercial Telephone and Electrical Co., Ltd.

Public Services Committee. Recommended:—
Annual contracts for "Argon" gasfilled and "Osram" electric lamps.—General Electric Co., Ltd.

Manchester.—Electricity Committee.
Electric cookers for six months.—Jackson Electric Stove Co., Ltd.
Switches and cutouts for six months.—J. H. Tucker & Co., Ltd.; Tok Switches, Ltd.; Edison Swan Electric Co., Ltd.
Motor converters.—British Thomson-Houston Co., Ltd.; Bruce Peebles and Co., Ltd.
Rotary converter and transformer.—Mather & Platt, Ltd.
Weldless steel lamp columns and fittings for street lighting.—British Mannesmann Tube Co., Ltd.; Bromford, Ltd.

Salford.—Electricity Committee. Accepted:—
Coal for six months:—
For Agecroft power station: 2,500 tons Astley 2-in. dry slack (17s. 9d. per ton).—Clifton & Kersley Coal Co., Ltd. 2,500 tons Agecroft Colliery 1-in. dry slack (17s. per ton).—A. Knowles & Son, Ltd. 2,500 tons No. 1 washed slack (18s. 6d. per ton); 2,500 tons best dry slack (17s. 9d. per ton).—Bridgewater Wharves, Ltd. 2,000 tons best washed pea slack (17s. 10d. per ton).—J. B. Scholes & Son, Ltd.
For Frederick Road power station: 2,500 tons No. 2 washed slack (24s. per ton).—Clifton & Kersley Coal Co., Ltd. 2,500 tons of washed peanuts (24s. per ton).—A. Knowles & Sons, Ltd.

St. Helens.—Electricity Committee. Recommended:—
C.i. circulating-water pipes.—Stanton Ironworks Co., Ltd.
Steel pipes.—R. Daglish & Co., Ltd.
Electricity meters.—Ferranti, Ltd.
Unit-type feeder pillars.—W. T. Henley's Telegraph Works Co., Ltd.
Repairs to cooling towers.—Peter Brotherhood & Co., Ltd.

Stoke-on-Trent.—Town Council. Accepted:—
Erection of sub-station at Wolstanton (£1,080).—P. Pemberton.

Uruguay.—According to the *Review of the River Plate* for February 6th, the contract for cables and accessories for Concepcion del Uruguay required by the Department of Sanitary Works has been awarded as follows:—22,000-V three-conductor cables; accessories for ditto; l.p. cables and wires. Total amount of contract, $73,974 pesos paper. W. T. Henley's Telegraph Works Co., Ltd. Various accessories, including fittings, switches, and wooden posts, &c. Total, $24,779.70. A. E. G. Cia Sudamericana de Electricidad.

Forthcoming Events.

Salford Technical and Engineering Association.—Saturday, March 7th. At the Royal Technical College, Salford. At 7 p.m. Paper on "H.p. Switchgear," by Mr. V. A. Brown.

Institution of Electrical Engineers.—Informal Meeting.—Monday, March 9th. At the Institution, Victoria Embankment, W.C. At 7 p.m. Discussion on "Illumination," to be opened by Mr. C. W. Sully.

Irish Centre (Dublin).—Thursday, March 12th. At Trinity College, Dublin. At 7.45 p.m. Paper on "The Use of Electricity in the Chemical Industries, with Particular Reference to the Irish Free State," by Dr. J. F. Crowley.

(North-Eastern Centre).—Monday, March 9th. At Armstrong College, Newcastle-on-Tyne. At 7.15 p.m. Paper on "Electricity in Mines," by Major E. I. David.

(North-Midland Centre).—Tuesday, March 10th. At the Hotel Metropole, Leeds. At 7.15 p.m. Paper on "Three-wire Direct-current Distribution Networks: Some Comparisons in Cost and Operation," by Mr. H. W. Taylor.

(Scottish Centre).—Tuesday, March 10th. At the North British Station Hotel, Edinburgh. At 7 p.m. Paper on "Iron Losses in d.c. Machines," by Mr. E. Hughes.

(South-Midland Centre).—Wednesday, March 11th. At the University, Birmingham. At 7 p.m. Paper on "Electricity in Mines," by Major E. I. David.

(Dundee Local Centre).—Thursday, March 12th. At the University College, Dundee. At 7.30 p.m. Paper on "Some Problems of County Distribution," by Mr. J. P. Thomson.

(North-Western Centre, Students' Section).—Tuesday, March 10th. At the Milton Hall, Deansgate, Manchester. At 7.30 p.m. Paper on "The Control of Storage Batteries," by Mr. W. H. Miller.

(Sheffield Students' Section).—Wednesday, March 11th. At the University, Sheffield. Paper by Mr. J. R. Hornby.

(London Students' Section).—Friday, March 13th. At Anderton's Hotel, Fleet Street, E.C. At 6.45 p.m. Annual dinner.

Northampton Engineering College Engineering Society.—Monday, March 9th. At the College, St. John Street, E.C. At 5.30 p.m. Paper on "Recent Developments in Generation and Transmission of Electric Power," by Mr. M. G. Holmes.

Institution of Civil Engineers.—Tuesday, March 10th. At the Institution, Great George Street, S.W. At 6 p.m. Paper on "Measurements of Discharge Over a Rock-faced Dam," by Prof. S. M. Dixon and Mr. F. W. Macaulay.

Royal Institution of Great Britain.—Tuesday, March 10th. At 21, Albemarle Street, W. At 5.15 p.m. Lecture on "The Evolution of the Scientific Instrument," by Prof. E. N. da C. Andrade.
Saturday, March 14th. At 3 p.m. Lecture on "The Counting of the Atoms," by Sir Ernest Rutherford, F.R.S.

Association of Mining Electrical Engineers.—Tuesday, March 10th. At the Engineers' Club, W. At 6.30 p.m. Paper on "The Design of Controllers for Electric Winders and Haulages," by Mr. A. West.

National Association of Supervising Electricians.—Tuesday, March 10th. At St. Bride's Institute, E.C.4. At 7.15 p.m. Paper on "Installation Work," by Mr. W. J. Revell.

Institute of Metals.—Wednesday and Thursday, March 11th and 12th. At the Institution of Mechanical Engineers, Storey's Gate, S.W. Commencing at 10 a.m. each day. Annual General Meeting.

Junior Institution of Engineers.—Friday, March 13th. At 39, Victoria Street, S.W. At 7.30 p.m. Lecturette, "Notes on Methods of Producing Modern High-grade Machine Tools," by Mr. A. P. Bale.
Saturday, March 7th. At the Holborn Hall. Annual Dance.

British Electrical Development Association.—Friday, March 13th. At Caxton Hall, S.W. At 7.30 p.m. Paper on "Development of Electricity Supply in Residential Areas," by Mr. R. Hardie.

The "Electrical Review" Service Department.

Inquiries must be accompanied by a stamped addressed envelope.

We should be glad to learn the names of makers or suppliers of:—

See-Dro wood separators for batteries.
Rex self-generating brushes.

Notes.

High-Pressure Conference.—The president of the Union des Syndicats de l'Electricité, speaking at a meeting of the board of management last week, stated that three new countries—British India, Australia, and Rumania—had announced their intention to participate at the conference on high-pressure networks to be held in June. These additions will bring the number of participating countries up to 23.

French State Electrical Repair Shops.—The French State Railway Administration has just completed the construction of large workshops at Garenne-Bezons for the purpose of carrying out the repair of the electric traction material and of that of the works, sub-stations, transforming stations, &c. The shops are situated near the Folie railway station and occupy a superficial area of 42,000 square metres, of which one half has already been built upon.

Report on Railway Accident.—Col. J. W. Pringle has reported to the Ministry of Transport upon the circumstances of a collision which occurred at the Haymarket Station, Edinburgh, on July 28th last, involving the death of five passengers and the injury of 54 others. In his conclusions, Col. Pringle attributes the accident to the misreading of a signal by the driver of one of the trains involved. Among other recommendations, the inspector states that a system of automatic train control, whereby the continuous brake is applied on a train when a driver passes a stop signal at danger, is, in his opinion, the most reliable method of preventing an accident of this character.

Local Societies.—Mr. W. J. Jones, of the E.L.M.A. Lighting Service Bureau, London, lectured on Friday night before the members of the Birmingham Electric Club on "The Economic Value of Good Electric Lighting." He emphasised the need for more electric light in factories on the ground that it was economically justified. It had been proved that with more and better light there was an increase in production, and the cost of that extra light was small, being in the case of one customer only 2 per cent. of the pay bill.

Condenser Water Intakes.—Dr. James Ritchie, of the Royal Scottish Museum, in the course of a paper on "The Control of Mussels in Sea-water Pipes," dealt with the results of experiments devised to prevent the blocking of the sea-water condenser cooling pipes at the Portobello electricity generating station, Edinburgh, by mussels and other marine growths.

The Shannon Scheme.—Mr. L. J. Kettle, city electrical engineer, Dublin, and hon. secretary of the Electricity Supply Association of Ireland, with regard to Mr. McGilligan's speech on the Shannon scheme (see our "Lighting and Power Notes"), urges that it would be dangerous and ill-advised to rush it through Parliament as the Minister apparently proposes to do. The fullest possible discussion and criticism are required. "The country," says Mr. Kettle, "is not in urgent need of the promised power supply, and will, in any case, have to wait several years before it gets it, so that a few months more or less will not matter very much. The members of this Association, which is representative of the present power suppliers, are legitimately and vitally interested in any national power supply proposals. The Association decided not to enter into any controversy about the Shannon scheme until they had the printed report in front of them. Two months have elapsed since the Minister made his statement in the Dail, and it would appear that the report should be ready by this time, if it was sufficiently complete two months ago to enable the Minister to express such a definite opinion about the subjects dealt with in it. The Liffey power bills have been available and have been discussed, in the usual constitutional private bill way, for the past three months, and it will, no doubt, be a considerable time longer before the discussion will have been completed. The Shannon scheme is a much bigger one, and it is to be hoped that opportunity will be given for at least as exhaustive a discussion of it."

Engineering Museum for U.S.A.—From *Power* we learn that a scheme for a National Museum of Engineering is advocated with the approval of the Federal authorities. It provides for a central museum in Washington, D.C., with a chain of sectional branches in industrial centres throughout the country. It is intended to place the museum under the direction of the Smithsonian Institution and that the central museum will receive exhibit articles from the Government offices, such as the Patent Office, the Bureau of Standards, &c., depicting the dramatic evolution of engineering and the industries. The suggested location for the building is in the Mall opposite the National Museum.

Telephone Research in America.—The growth of the research and development work of the Bell telephone system of America has led to the formation of Bell Telephone Laboratories, Inc., which was organised on January 1st for the purpose of carrying on development and research activities in this large corporation, says the *Financial Times*. The new company, which is jointly owned by the American Telephone and Telegraph Co., and the Western Electric Co., Inc., has taken over the laboratories of the two companies mentioned, and a new building is to be erected for the purpose in New York. The chairman of the board of the new concern is General J. J. Carty, vice-president of the American Telephone and Telegraph Co.

The Corrosion of Condenser Tubes.—In a paper read before the Liverpool Engineering Society on January 21st, the author, Mr. R. E. Gibson, M.Inst.C.E., expounded the results of some interesting experiments that had been carried out with a view to the prevention of the corrosion of condenser tubes. The experiments were undertaken on marine condensers in order:—

1. To try to obtain a condenser tube made of a metal which would stand up to the corrosive effects of seawater.
2. To find a means of forming protective film which could easily be applied to the inside of a tube.

It was found in the first case that tubes made of copper-nickel and copper-tin alloys stood the conditions comparatively well. The second experiments were very successful, it being discovered that by coating the insides of the tubes with a bituminastic solution the corrosion was eliminated to a very great extent. The solution was applied to the tubes by means of a specially devised spraying plant, described in the paper, being blown through a long-nozzled spray gun by means of compressed aid, the tubes, of course, being thoroughly cleaned and dried before the solution was applied. Two coats of the solution were applied, each coat being dried by means of fans, and a spiral hair brush was passed through the tubes immediately after application, to deal with the flooding of the solution which took place at the bottom of the tubes. On examination it was found that the tube surfaces were coated with an evenly-distributed, thin, smooth and glossy layer of the dried "bitumen." The success of the experiment was evidenced by the fact that out of 10 condensers (28,500 tubes) which had been treated, only 21 tubes had failed in periods varying from three to ten months, and on examination of the failures it was found that the corrosion which had taken place before the coating was applied, was such that it was impossible for the tube to last.

Optimum Damping of Radio Signals.—In a paper recently read before the Wireless Section of the Institution of Electrical Engineers, Messrs. L. B. Turner, M.A., M.I.E.E., and F. G. Best, M.Sc., Student I.E.E., gave an account of an experimental investigation of the extent to which it is advantageous to reduce the damping in a receiver for telegraphic signals from modern continuous-wave stations, when the usual rectifier and telephone are used as indicator. It was found possible to produce, hold stable, and measure decrements below those giving optimum reception. Numerous determinations of optimum damping were made, the observed signals coming from six commercial transmitting stations of wavelengths ranging from about 4,000 to 23,000 m. The several observations on any one station show remarkable accord amongst themselves, and the measured optimum damping exponents for all stations and wave-lengths lie within a narrow range. The significances of speed of signalling in relay and in auditive reception are contrasted.

Although the stations observed cover frequencies extending from 69×10^3 to 13×10^3 periods per second, the values of the product lie within the narrow range of 143 to 99. The view that it is the shape of the rising and falling portions of the amplitude time curves which determines the optimum decrement, is thus strongly supported.

All the signals observed were of hand speed, and no indication that the value of the optimum decrement depended on the speed was noticed. The authors' opinion is that, however much the speed of sending might be reduced, the optimum damping for auditive reception would not fall appreciably below the values found in the experiments. The optimum damping of the receiving circuit must, of course, depend on the sharpness of rise and fall at the sending antenna, the more the inertia there the less being the inertia tolerable in the receiver. It seems probable that the transmitter's share in the total inertia effects is small in comparison with that in a receiver in which $n\delta = 100$, n being the frequency of the signal e.m.f. and δ the decrement of the receiving circuit. If it were not, the uniformity of the observations on stations covering so wide a range of wave-lengths, and including arc, alternator, and triode generators, would be very surprising. It does not seem possible to infer from the observations any distinctions between the qualities of signalling, from the standpoint of the inertia effects studied, with the above-mentioned three different types of generator.

It may be concluded that the optimum damping for the auditive reception of signals from any modern continuous wave-station is such as to make the $n\delta$ of the receiving circuit of the order of 120, which corresponds to $\delta = 0.0012$ at $\lambda = 3{,}000$ m, and $\delta = 0.008$ at $\lambda = 20{,}000$ m; that such decrements are easily obtained by triode retroaction; and that with suitable care they may even be measured with considerable precision.

New Method of Measuring H.F. Resistance.—The paper recently read by Prof. E. Mallett, M.Sc., M.I.E.E., and Mr. A. D. Blumlein, B.Sc., Student, before the Wireless Section of the Institution of Electrical Engineers, describes a new method of high-frequency resistance measurement in which the resistance of an oscillatory circuit is measured at resonance. The circuit, the resistance of which is to be measured, is coupled magnetically with a coil, and the magnitude of the ratio of the effective impedance of the coil to that of the coil alone is measured at various points as resonance of the circuit is passed through by alteration of the frequency of the supply. A resonance curve of the impedance ratio is plotted against the supply frequency, and from this curve the high-frequency resistance of the circuit is determined by the use of a graphical construction involving a circle diagram. The construction gives also the value of the resonant frequency of the circuit. Alternatively, if the tuning of the oscillatory circuit can be varied by means of a variable condenser, the impedance ratio curve can be obtained without variation of the supply frequency.

The advantages of the method are briefly:—

(*a*) The circuit to be tested has no electrical connections made to it and its tuning need not be altered, thus making the method suitable for measuring the resistance of coils at their natural frequency, and in other circumstances where change of tuning is impossible.

(*b*) No absolute measurements need be made, except that of condenser change; other measurements need be only "comparative."

(*c*) The resistance is determined by a number of points lying on a straight line; an estimate of the accuracy of a measurement may be obtained by observing whether or not the points do lie on a straight line.

The value of the mutual coupling does not appreciably affect results, as is shown by the agreement obtained with varying couplings. With tight couplings there may be an error due to losses in the search coil, produced by flux from the circuit to be tested; these losses would appear as extra resistance in the circuit to be tested. There can be little doubt that the decay factor of the circuit under test in the circumstances and surroundings under which the test is made is quite accurately obtained. The inaccuracies all occur in converting this decay factor to a resistance, and for many purposes in wireless work this conversion is unnecessary.

The graphical construction appears a little complicated and laborious at first sight, but is more apparent than real. The measurements on and construction of the toroidal coil, made after most of the apparatus has been assembled, were completed within two hours, which included setting up some of the apparatus. The fact that a number of points was obtained which should lie on a straight line is a very helpful guide as to the accuracy of the results, and for this reason it is advisable (at least until one is fairly sure of the constancy of the valve conditions) to include some points outside the steep part of the curve.

Any capacity coupling between the two coils is not sufficient under the circumstances of the tests to influence the results to produce a resonance curve with condenser coupling alone, a far greater value for the condenser is necessary than any possible between the coils in their usual positions.

The measurement of the departure of the frequency of a supply from the natural frequency of a given standard circuit can certainly be made with very great accuracy, and this method of frequency determinations may be of value. The application of the method to the accurate determination of wavelength is suggested, and a considerable field of investigation is opened up by the results obtained. It is hoped to continue the work in the Telegraph and Telephone Laboratories of the City and Guilds (Engineering) College, where the whole of the present work was carried out.

Accident.—Joseph Bell (27), a cable jointer in the employ of the Leeds Corporation Electricity Department, was engaged with other men in changing over a cable in Canal Road, Armley, late on the night of February 24th, when a short circuit caused an explosion. Bell was taken to the Infirmary suffering from severe burns on the face and arms and was detained.

Electric Heating in Steel-framed Bungalows.—The steel-framed principle is being adopted in the construction of a sample pair of "Crane" type composite houses, which the Nottingham City Council is having built by Messrs. John Booth & Sons, Bolton, as part of its housing scheme. These are of the bungalow type, containing a parlour, living room, two bedrooms, bathroom, lavatory, scullery, larder and small hall. A combination cooking and heating range will be provided in the living room and the rest of the rooms will be heated by electric fires.

This Week's Stories.—We cull the following note from a Yorkshire newspaper:—

"ADWICK-LE-STREET.—*Pushing Ahead.*—A meeting of the Electricity Committee of the Urban Council was held on Thursday, and steps were taken to push along with the scheme with unnecessary delay."

Alas! this happens far too frequently.

Another contemporary at Glasgow says:—"There is little doubt that electric sins are rapidly assuming popularity as a method of advertising." Surely such lapses should not be given too much publicity!

B.E.S.A. Conference on Building Materials.—The British Engineering Standards Association, at a fully representative conference recently held at the Institution of Civil Engineers, decided, after consideration of a request from the Committee of the Privy Council of Scientific and Industrial Research supported by the Ministry of Health, to set up a Sectional Committee to deal with building materials generally.

Mr. L. B. Atkinson, a member of the Main Committee of the B.E.S.A., was in the chair and representatives were present from municipal authorities, technical institutions, the railway companies, general users of building materials, various associations and the Government departments. A watching brief for the manufacturing interests was held by representatives of the Federation of British Industries.

Modern Shop Lighting.—The first of the informal visits being arranged by the Illuminating Engineering Society was considered a decided success. The party was a large and representative one and the discussion furnished a good example of the advantages of an interchange of views between lighting experts and users of light. Mr. H. J. Clarke, manager of the staff at Messrs. Selfridge's, though representing the user's standpoint, proved to be quite conversant with the principles of lighting and was able to give the members of the Society much interesting information. Both the stores visited afford excellent examples of modern shop-lighting, and illustrate the broad view now taken of the value of good illumination as a commercial asset. The educational value of such meetings as this can scarcely be over-estimated, and the lighting industry should be grateful to the Society for the good work it is doing. We understand that the next of these informal gatherings will deal with railway station lighting, a fruitful field for the exercise of the influence of the Society.

On February 18th the first gathering took place at the Army and Navy Stores, where visitors were conducted through the various departments and had an opportunity of viewing the lighting arrangements in detail. Special interest was shown in the ingenious method of flood-lighting the frontage by means of projectors placed below panels of diffusing glass let into the pavement. The party was then conveyed to the premises of Messrs. Selfridge & Co., Ltd., where it was welcomed by Mr. H. J. Clarke, manager of the staff, Mr. A. E. Bangs, chief engineer, and Mr. H. Seal, manager of the display department. After examining the flood lighting (one of the earliest installations of this type in London) and the lighting of the show-windows, visitors were conducted through typical sections of the building illustrating the usual methods of interior lighting, and finally assembled in the refreshment room.

Mr. Clarke presided ably over the subsequent informal discussion, replying in turn to the various points raised, and Mr. L. Gaster, Mr. P. J. Waldram, Mr. A. E. Bangs, Mr. R. F. Riley, Mr. L. E. Buckell, Mr. H. Seal, Mr. J. S. Dow, Dr. James Kerr, Mr. R. A. Ives, Mr. T. E. Ritchie, and others took part, and Mr. Clarke endorsed the view that in a modern store it is good policy to aim at the best possible conditions of illumination. It was suggested that in large and somewhat complex stores more use might be made of illuminated indicator-signs, and that in the display of coloured goods "artificial daylight" might be more widely utilised. Another problem, of great consequence in a large building, is the cleaning and maintenance of lighting units. From this standpoint the use of enclosed units, *e.g.*, globes of diffusing glassware, appears to be advantageous.

The British Association.—Arrangements for the Southampton meeting, which is to be held from August 26th to September 2nd, are well in hand. This year's president is Dr. Horace Lamb, formerly Professor of Mathematics in the University of Manchester. Among the sectional presidents are Dr. Desch (Professor of Metallurgy, Sheffield University)—Chemistry; Sir Archibald Denny—Engineering; and Miss Lynda Greer (Principal of Lady Margaret Hall, Oxford)—Economics. There will be a number of joint discussions, including one on transport problems between the engineering and economics sections, and another on the ignition of gases between the engineering and chemistry sections.

Electric Vehicles in France.—The first 20 of a fleet of electric omnibuses have recently been put in service in Lyons by the New Lyons Omnibus Co. The vehicles were supplied by De Dion-Bouton Co., of Paris, which was responsible for all but the electrical equipment, which has been supplied by Messrs. Rognini & Balbo, of Milan. The omnibuses are of the single-deck type constructed to carry 40 people, 28 seated and 12 standing on the rear covered platform; they have a wheelbase of 14 ft. 9 in., a track of 5 ft. 11 in., and an overall length of 23 ft. 6 in. Two electric motors, each of 12 nominal h.p., are mounted on the rear axle which is driven through spiral-bevel gearing. The motors oscillate about the rear axle, and are linked to the chassis by means of spring-compensated rods. The controller gives five forward and two reverse speeds. The batteries are slung in a box beneath the frame, and carried centrally between the axles. A special system of slinging is adopted by means of which a discharged set of batteries can be replaced with a fully charged one in twelve minutes.

Railway Station "Loud Speakers."—If experiments are successful, a loud-speaker is to be placed over the big clock at St. Pancras Station, and an official, speaking into a microphone in his office, will announce the arrival and departure of trains in tones which will, it is hoped, be heard all over the station.

The Late Mrs. Ayrton.—Miss Evelyn Sharp, who is engaged in writing the biography of the late Mrs. Hertha Ayrton, *née* Marks, the physicist, requests any of our readers who possess letters or information concerning any period of her life to communicate with her as speedily as possible at 16, John Street, W.C.1.

Electric Homes in the United States.—A recent supplement to *Electrical Merchandising* contained statistics showing the proportion of homes in which electricity is installed to the total number in each of the States of the Union. From this it is seen that the State which is most advanced electrically is Utah, in which State 105,480 homes out of a total of 107,500 are wired, or 98.2 per cent. In California the proportion is 96.5 per cent. Many other States have a proportion of over 50 per cent., and only three are below 20 per cent.

English in the Orient.—The following "literary gem" has been sent us by a correspondent, who vouches for its authenticity as an application for employment in a power station; the original is type-written:—

5th January, 1925.

To The Officer in Charge & Superintendent,
Electric Power House,

Sir,

I, the undersigned being in need of some suitable service under your kind control most humbly and respectfully beg to approach your honour with the following few lines for your favourable consideration,

1—That I have experience of Electrtion And Mechanical works since last 20 years and I am well acqusinted from the following works,

1—armature winding A,C. and D.C. high Voltage to low voltage D.C. winding, Loop dum &simons winding A.C. winding single piece, double piece and tripple piece, all armature winding, dynamos motor & fans Kilowatt-hours Meter repairing A.C. and D.C.

2—Power house, switich board large, A.C. & D.C. moving coil tape etc fixing repairing measurement, tested switch board and instalation lights, main line. feeder line, line inspectors works new line and poals fixing and make the distribution for main lines, Apart from this I am well acquainted from the Telephone works & Wireless telephone switch board works, repairing and new fixing and also I am Fully Aware of Sorts of Electric works,

3—I am also well expeienced from the Mechanical Lines also such as oil Engines, for all kinds Dizal Engines, Ruby dizal Engine. and motor Engine, new fixing and repairing, fitter, turner and Black smith work—

I possess certificates for all the lines worked by me as the copies of my such certificates are enalosed hereunder for your kind perusal

4—I may bring to your kind notice that I had my own shop for the above work on ——— Road in ——— Since Last 10 years in the name and style of ——— And Coy: which I have given to my subordinate due to the work being very slack and impossible for two persens to pull on a days,

5—I have worked for full 7 years for Government as Electric and Mechanical contract for ——— District and have given given entire satisfaction to my superiors for work done by me during these days which all the accompanied certificates will speak to your honour.

If you can afford to provide me at yours in any line I shall be much obliged if you shall let me know that what pay you can offer me,

Awaiting your earliest reply, Thanking you in anticipation,

Ibeg to remain,
Sir
Your most obedient servent
i.e. ———
Electrition and mechanical

Cable "Cheese."—A number of American companies using paper-insulated cables at high voltage have recently observed a peculiar "cheese" or waxlike formation in cables which have been in operation for some time. In many cases this formation accompanies cable failures, but so far there is no definite proof that it is a cause of failure. The Research Bureau of the Brooklyn Edison Co. has been making an intensive study of this phenomenon to determine its nature and significance, and in a number of samples of "cheese" removed from cables near the point of failure, it has been possible to detect impurities of a quite unexpected nature. Experiments are now in progress to determine what part these impurities play in the formation of the "cheese" and what effects it may have on the breakdown of the cable.—*A.I.E.E. Journal.*

Fatalities. — A verdict of "Accidental death" was returned at an inquest by the Sheffield coroner at Wath on Thomas Colston (46), who was killed at the Wath Main Colliery on February 17th. A witness stated that he and Colston were turning the handle of the tipping screw of a motor lorry which had been backed to a stone crusher, when they received an electric shock, the screw having caught one of the cables supplying the machine. The cable was knocked away with a piece of wood, and both men fell to the ground. Colston was found to be dead. The chief electrician at the colliery stated that in his opinion the tipping screw made a very fine cut in the insulation of the cable, and that contact was thus made through the screw to the winding handle.

At an inquest last week into the death of William Barwick and Benjamin Martin, Bloenrhondda, it was stated that as the men were leaving a colliery at the end of a shift an overhead cable broke and one end came into contact with a signalling wire. The two men were killed and three others injured. A verdict of "Death from misadventure" was returned.

Scientific Publications.—As the result of representations made by the National Union of Scientific Workers, the Treasury has decided to increase the grant to the Royal Society for scientific publications from £1,000 to £2,500 in the next estimates.

Appointments Vacant.—Clerk for the Cheadle and Gatley Urban District Council electricity undertaking; lecturer in the Department of Electrical Engineering, Sunderland Technical College; assistant engineer, for the Aden Settlement Electricity Supply Undertaking. (See our advertisement pages to-day.)

The Preparation of Tenders.—In a paper on the above subject, read before the Society of Engineers by Mr. R. I. Money, M.Inst.C.E., on March 2nd, he said the only accurate method in preparing a tender was to make a careful detailed calculation of the "Prime Cost" (materials and labour) of the different items, and add thereto further items of cost, generally known as "On Charges" or "On Costs."

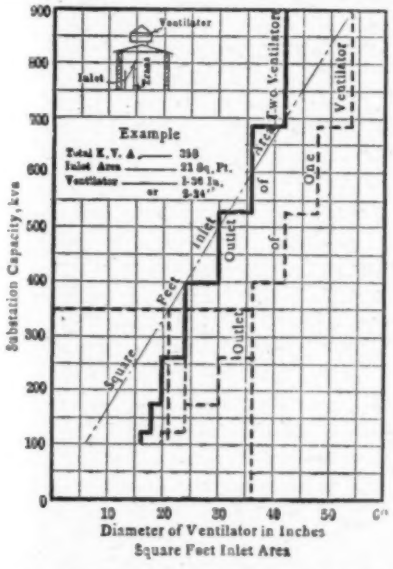
The "Specification of Works" should be carefully studied and attention drawn to any special points or clauses. In an explanation of the bases of costs for labour, materials and transport, the author showed how the cost of excavation, concrete and masonry could be calculated, and how the method adopted by some estimators of assuming that a 1-4-8 mixture made 8 cubic yards of concrete gave a result higher than the actual cost, because one cubic yard of cement with 4 cubic yards of sand and 8 cubic yards of broken stone, made 9.8 cubic yards of concrete. The estimators worked on the erroneous assumption that the cement was absorbed by the voids in the sand, and the resulting mortar by the voids in the broken stone.

The question of plant was dealt with in considerable detail, more especially with regard to depreciation and repairs. A method coming into use in the United States was explained, under which a daily rental charge is made to the contract on which it is employed, from the date on which each piece is loaded for shipment until it is again loaded for return to its owner.

FIRST WOMAN MEMBER.—For the first time since its formation in 1854, the Society of Engineers (Incorporated) has elected a woman member, Miss Annette Ashberry, works manager of Atalanta, Ltd., 479, Fulham Road, S.W.6. Miss Ashberry is a member of the Women's Engineering Society and did excellent service during the war as an engineer.

Newcastle Electro-Harmonic Society.—Monday, March 16th, is the date of a Ladies' Guest Night of the Newcastle-upon-Tyne Electro-Harmonic Society. It will commence at 7.30 o'clock prompt in the Prince of Wales Room at the County Hotel. Dr. W. M. Thornton will be in the chair. This is the last concert of the Society for this season.

The Ventilation of Transformer Vaults.—The question of the ventilation of underground transformer pits is one for consideration when a pit is being designed. A chart prepared on similar lines to the one we reproduce from the *Electrical*



World should be helpful in deciding the necessary sizes of air inlets and ventilators for particular sizes and capacities of pits or underground sub-stations. The chart, it is claimed, is in use by a large power company and is based on a temperature rise of 10 deg. C. above the temperature of the inlet air for vaults 9 ft. high.

Radio Control of Aircraft.—An official French commission is to make final trials at Istres, near Marseilles, of apparatus for the radio control of aeroplanes. According to the *Daily Mail*, an operator at a switchboard on the ground controls the machine by the pressure of keys. Its equilibrium is made automatic by gyroscopes, and its engine-plant is automatic also. The feature which is said to be of importance is a new means of controlling the machine after it has passed beyond the visual range of ground operators. It is stated that after it has traversed a certain distance it emits automatically a series of radio signals. These enable the position of the machine to be ascertained by ground operators, who, if necessary, can send signals correcting or altering its course.

The Limiting Possibilities in Steam Plant.—In a paper read before the North-East Coast Institution of Engineers and Shipbuilders, the authors, Prof. A. L. Mellanby, D.Sc., Assoc. Member, and Prof. William Kerr, Ph.D., establish after a progressive determination of the essential limits to the sequence of operations in steam plant a limiting and explicit cycle of operations. The paper first deals with the temperature limits which are governed by the weakness and deterioration of metals under high temperature conditions. The pressure limits are next dealt with in a study of thermal efficiencies and how they are affected by pressure increase. Following these considerations, the examination then passes to the questions of the number and extent of the reheating stages, and finally to the extent of feed-heating.

The cycle deduced starts from initial conditions of 900 deg. F., with a pressure of 1,250 lb./in.², involves re-superheating at intermediate pressures of 500 and 180 lb./in.², and includes the employment of about eight extraction feed heaters, equally stepped, on a range of liquid heats up to that corresponding to 1,000 lb./in.² pressure.

On a basis of oil at 19,000 B.th.u./lb., the net result is 0.495 lb. oil per kWh. or 0.37 lb. per h.p.-hr. covering the transformation from oil to turbine power, but excluding auxiliaries. This may be presented as the ultimate possible limit in the operation of high power units under the best conditions in land plant.

Sir Charles Parsons gives an estimate of performance based on conditions of 5,000 h.p., 500 lb./in.², and 700 deg. F., with extraction feed heating, but no reheating. His estimate is 0.57 lb. oil/s.h.p.-hr. for turbines only.

Pumping Tests.—Mr. I. Hargrove, lecturing to members of the Association of Mining Electrical Engineers at the Birmingham University, on Friday evening, on "Some Problems in Pumping," advocated standard tests for pumping as for boiler testing.

Institution Notes.

Institution of Electrical Engineers.—At the informal meeting on February 23rd, Mr. H. T. Young was in the chair, when Mr. W. E. Warrilow opened a discussion on "Electrical Journals." He said he was the last man to disparage the Press, for which, with slight reservations, he had the greatest admiration. He outlined the history of electrical journalism down to the present day, and described the growth in size and number of the journals, great and small, which the electrical world supports. A comment on the possibility of the advertiser having an undue influence on the policy of a journal was dealt with by more than one speaker, but the discussion revealed no misgivings on this score, while very good reasons against such a possibility were given. A large number of speakers took part in the subsequent discussion.

SCOTTISH CENTRE.—On Friday, April 24th, at 2.15 p.m., at the Technical Institute, Dundee, there will be a discussion on the "Justifiable Small Power Plant," with introductory remarks by Mr. A. B. Mallinson. Arrangements will be made before the meeting for luncheon at the Royal Hotel, and the Lord Provost and Magistrates of Dundee will hold a reception at 7 p.m. in the Art Galleries, Albert Institute. On the following day charabancs will leave Albert Institute at 10.20 a.m. for Edzell, where a stay of some hours will be made. Luncheon will be served at the Panmure Arms Hotel, Edzell, and the return journey to Dundee will be *via* the Bruce Hotel, Carnoustie, where afternoon tea will be provided. Ladies and other friends will be welcome at all these meetings and functions. Particulars can be obtained from Mr. W. Frain, hon. secretary, Dundee Sub-Centre, 38, Nethergate, Dundee, or Mr. Joseph Taylor, hon. secretary, Scottish Centre, 153, West George Street, Glasgow, C.2.

Royal Institution.—On Tuesday next (March 10th), at a quarter past five, Prof. E. N. da C. Andrade begins a course of two lectures at the Royal Institution on the "Evolution of the Scientific Instrument": and on Thursday, March 12th, Dr. Leonard Hill delivers the first of two lectures on the "Biological Action of Light."

Junior Institution of Engineers.—In a lecturette entitled "A Treatise on Modern Lighting Practice," delivered before the Junior Institution of Engineers on February 27th, Mr. F. Stroud demonstrated the use of reflectors and refractors and the effect of arranging light in different places relative to the objects or areas to be illuminated. He explained how the light from an electric lamp could be concentrated by the use of prisms, and showed illustrations of polar curves of bare and shaded lamps and one or two slides of actual lighting installations.

In the discussion which followed Mr. Stroud said that people paid to have their windows cleaned, although daylight cost them nothing, and yet they often did not clean the apparatus for lighting, for which they had to pay. Glassware used in shades of gasfilled lamps had been tested up to 200 deg. C., and the working loose of lamp caps had been found to be capable of remedy. In discussing light which would penetrate fog, it was concluded that an artificial light to replace the sun which was blotted out would not easily be found.

The Indian Institution of Engineers.—*The Times* states that the fifth annual dinner of the Institution of Engineers in India was held in Delhi on February 25th. Sir Charles Innes, member for Railways in the Indian Government, complimented the Institution on its progress and its membership, which is expected soon to reach 1,000.

Our Personal Column.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Mr. W. Preston (head of Messrs. W. Sanders & Co., of Wednesbury), who was recently disqualified as Member of Parliament for Walsall in consequence of his holding two contracts for electrical fittings for the G.P.O. Stores Department, stood for election again in the Unionist interest on February 27th and secured a majority of 2,493 over the Liberal candidate, Dr. T. J. Macnamara. His majority last October was 2,434.

The Hampstead Borough Council has passed the Lighting Committee's recommendation that the salary of Mr. J. Leadbeater, electrical engineer and manager, be increased to £900 per annum.

Mr. Thos. Roles, M.I.E.E., city electrical engineer of Bradford, has been suffering from a somewhat severe attack of gastric influenza, and on February 24th he underwent an operation, which has been successful. Mr. Roles was to have addressed the Bradford Rotary Club, on February 25th, on the Bradford electricity undertaking.

In recognition of his appointment as President of the Institution of Electrical Engineers, Mr. W. B. Woodhouse, engineer and manager of the Yorkshire Electric Power Company, was last week presented by the staff of that company with a grandfather clock. The presentation was made by Mr. W. Moizer, one of the oldest employés of the company.

On February 26th, Mr. James B. Dow, F.C.I.S., I.A.A., chief clerk in the Glasgow Corporation Electricity Department, was presented by his colleagues with a canteen of cutlery and some books, also an ostrich leather handbag for his wife, on the occasion of his leaving Glasgow to take up the appointment of assistant secretary to the Birmingham Electric Supply Department. Mr. R. B. Mitchell, chief engineer and manager, presided at the meeting, and the presentation was made by Mr. R. B. Maccall, secretary and treasurer.

Commander C. W. Craven, R.N., who has been a special director in charge of the Vickers works at Barrow-in-Furness, has been elected on the Board of Vickers, Ltd.

The Reigate Town Council has increased the salary of the electrical engineer, Mr. W. S. Ross, by £75 a year.

Mr. G. C. Hadfield, showroom and sales manager, Wolverhampton, has been appointed by the Southport Electricity Committee to the position of showroom and sales assistant for the new electricity showrooms at the Glaciarium, at a salary of £350, rising to £390, subject to the Local Government Officers' Superannuation Scheme.

Mr. C. Honour, assistant mains superintendent at Cheltenham electricity works, has resigned, having obtained an appointment at Carlisle.

The *Review of the River Plate* understands "that Engineer Jose Pedriali, at present in Europe, will not resume the general managership of the Anglo-Argentine Tramways Co., having been appointed to a seat on the London Board."

At the Manchester Town Hall on February 26th, the Electricity Committee entertained the staff of the department and other guests, who came to welcome Mr. S. L. Pearce on his return from Australia, and to mark the completion by him of 21 years' service as chief engineer of the Electricity Department, and presented him with tokens of the esteem of the Committee and of the staff under his control—a grandfather clock from the Committee and a silver tea and coffee set and cut-glass bowls from the staff. Alderman Dagnall, the chairman of the Committee, presided over the proceedings, and there were also present the Lord Mayor (Alderman F. J. West), Alderman Sir William Kay, Alderman Bowes, Alderman Walker, and Mr. H. C. Lamb, the deputy chief engineer. A tribute to the progress of the municipal electricity undertaking under the guidance of Mr. Pearce, and the great part which he had himself taken in bringing this about, was paid by the Lord Mayor, who pointed out that the department had grown to six or seven times the size it was 21 years ago. Alderman Sir Joseph Kay observed that Mr. Pearce's had been a very brilliant career. In future developments the Gas Committee would always be found willing to co-operate in any scheme which would be to the advantage of the city. Gas and electricity had each their separate fields. Alderman Bowes said he was glad to give his testimony to the excellence of Mr. Pearce's work. Manchester had now one of the finest electrical stations in the kingdom. Mr. Pearce, in reply, said he could look back at the progress made by the Manchester electricity undertaking during the past 21 years with legitimate pride. The industrial power supply policy inaugurated in 1904 had placed the manufacturers of the city in a position to help the country very materially during the war period. In the policy of co-operation with their neighbours they had given expression to the idea that municipal boundaries were not necessarily the most economical for the distribution of power. The establishment of the Barton station represented, from the national standpoint, a substantial advance on anything hitherto accomplished in this country. The Manchester electricity undertaking was held in high regard by the people of Sydney; they told him that they regarded their own undertaking as second only to that of Manchester.

The progress of the past would be maintained in the future. Probably before the end of this year they would have to consider seriously the question of a further installation at Barton, and looming in the distance was the Carrington station, where they would be near the great gas station at Partington; perhaps this would hasten the advent of the close co-operation with that department which they desired. The kind hopes expressed by the Lord Mayor and others he very cordially reciprocated. He could assure them that it was not at all likely that his relations with the Manchester Corporation would be willingly broken.

A gathering of members of the staff of the electrical department of the L.N.E.R. took place in the electrical workshops at Grimsby last Saturday morning, when Mr. H. Gill, M.I.E.E., relinquished his position as district electrical engineer for the Lincolnshire district (G.C. Section). Mr. L. G. Jeffery, assistant district electrical engineer, speaking on behalf of the staff, said they much regretted the retirement of Mr. Gill from the control of the department, for it meant the severance of an association of many years' standing and the passing of the old *régime*. They desired to extend their good wishes to him. Mr. Wm. Hyde, the oldest member of the staff, then presented Mr. Gill with a silver cigarette case, cigarettes, and a gold-mounted fountain pen, and a silver purse for Mrs. Gill. Mr. Gill replied in suitable terms. He went into the district 14 years ago to superintend the electrical work during the building of Immingham Dock, upon completion of which he accepted the position of district electrical engineer for the Grimsby and Immingham Docks and Lincolnshire district. He now leaves for London to take up the position of district electrical engineer for the southern area of the L.N.E.R.

Mr. E. de H. Duval has severed his connection with the Electric Motor and Transformer Co., and has now taken up the position of director to Clayton Motors, Ltd., who are representing Messrs. Rayner & Heald for London and the Home Counties. His present address is Craven House, Kingsway, London, W.C.

Leeds Electricity Committee recommends that the salary of Mr. C. N. Hefford, the manager, be increased from £1,500 to £1,600 per annum.

Birkenhead Electricity Committee has appointed Mr. J. W. Cox an assistant to the mains superintendent at £230 per annum.

Obituary.—Dr. A. de Watteville.—The death of Dr. Armand de Watteville, which has just occurred at the age of 78 years near Geneva, after a prolonged and tedious illness, recalls the litigation in which this journal was involved in the year 1893, as the result of its electric belt criticisms and campaign. Dr. de Watteville had specialised for very many years in electro-medical science and he was the author of a work on "Medical Electricity," which went through two editions. He was a student of St. Mary's Hospital before going to France in 1870 with a British Red Cross Ambulance which accompanied the French armies. After a somewhat perilous experience he returned to England and took up his electro-therapeutical studies, subsequently making educational use of them at St. Mary's Hospital. *The Times* says: "He became a public enemy of medical quackery, particularly of the electrical charlatans who flourished . . . and he sometimes gave evidence in cases against medical frauds." It was this interest that influenced him to give evidence on our behalf in the then celebrated case of Tibbitts *v.* Alabaster and Others, in which the proprietors of the Electrical Review were sued for damages by a doctor whose statements had been attacked in these pages. Dr. de Watteville's evidence was briefly reported in our issue of February 24th, 1893. He stated that as a result of his special study of electro-therapeutics and his examination of the electric belts in question, in his judgment supposing that the belts were coupled up and applied to the body the current would have no therapeutical value at all. The verdict was given for the defendants.

Mr. R. C. Clowry.—A *Reuter* telegram from New York announces the death of Mr. Robert Charles Clowry, a former president and general manager of the Western Union Telegraph Co., at the age of 86.

Mr. F. G. Rison.—We learn with regret of the death, which occurred suddenly on February 16th, at the age of 46 years, of Mr. Frank G. Rison, of Cedar Avenue, Chelmsford, sales manager to the Sloan Electrical Co., Ltd., London. He had been with the firm for a considerable period, and during the war he held a commission in the Royal Air Force.

Mr. J. M. Henderson.—We regret to record that Mr. John M. Henderson, chairman and managing director of Messrs. John M. Henderson & Co., Ltd., makers of cranes and hoisting and transporting machinery, of Kings Works, Aberdeen, passed away on February 19th. Arrangements have been made to secure the continuity of the business.

Mr. F. C. Hunter.—We regret to record the death of Mr. Frederick Charles Hunter, assistant sales manager to W. T. Henley's Telegraph Works Co., Ltd., which occurred on February 28th in a nursing home in London, following a

critical operation. Mr. Hunter entered the service of Henley's 27 years ago, and his death will be a severe loss to the company. He was always a man of outstanding ability, and he possessed technical and commercial knowledge greatly above the average. He was highly esteemed by all his business associates, and his untimely death has brought great sorrow to his large circle of friends at Henley's.

MR. C. T. WILLIAMS.—The death is announced in *The Times* of Mr. Charles Thomas Williams, late of the Indian Telegraphs. He passed away on February 20th at the age of 58 years at "Beechwood," Grove Park, S.E.

MR. J. E. HOUGH.—We regret to record the death, which has occurred in a London nursing home, of Mr. James E. Hough, of Failsworth, near Manchester, managing director of the Edison-Bell Phonograph Co. It is stated that thirty years ago he received the British Rights for Edison's first talking machine, which he introduced to the market here. He was 73 years of age.

New Companies Registered.

Scientific Radio, Ltd. (204,059).—Private company. Registered February 24th. Capital, £1,000 in £1 shares. To carry on the business of electrical and mechanical engineers, manufacturers and repairers of, agents for and dealers in wireless and radio apparatus, including valve and crystal sets, amplifiers, loud speakers, headphones, spare parts, wireless or radio articles, &c. The first directors are:—F. G. Ketchbey, 261, Orphanage Road, Erdington, Birmingham; E. D. Gledall, 42, Anderton Park Road, Moseley, Birmingham; J. Hill, 56, Anderton Park Road, Moseley, Birmingham. Qualification, 1 share. Secretary: J. Hill. Solicitor: T. Davis, 20a, Temple Street, Birmingham. Registered office: 14, New Street, Birmingham.

National Wireless Corporation, Ltd. (204,057).—Private company. Registered February 24th. Capital, £1,000 in 1s. shares. To increase the popularity of wireless within the range of broadcasting areas by means of advertisement and otherwise, and to act as radio and general engineers, manufacturers, merchants and factors, &c. The first directors are:—W. Wrentmore, 202, Old Road West, Gravesend, engineer; R. M. Keith, 8, Vermont Road, Upper Norwood, S.E.19, builder. Qualification, 1 share. Registered office: 245, Shaftesbury Avenue, W.C.2.

Beasleys, Ltd. (204,066).—Private company. Registered February 25th. Capital, £2,000 in £1 shares. To carry on the business of contractors for the installation of electricity generating plants, electric lighting, electric power and the like in public and private premises, manufacturers of electrical machinery, &c. The first directors are:—Mrs. Louisa M. Beasley, 95, High Street, Whitstable; G. Knowles, 22a, Oxford Street, Whitstable, estate agent. Qualification, 100 shares. Solicitor: J. F. Whichcord, 1, Castle Street, Canterbury. Registered office: 95, High Street, Whitstable.

Thanet Electric Factors, Ltd. (204,119).—Private company. Registered February 26th. Capital, £500 in £1 shares. To carry on the business of wholesale factors and manufacturers of electrical accessories, switches, pushes, lamps, cables, conduits, batteries, accumulators, dry cells for bells and telephones, &c. The first directors are:—T. F. Young, Burford, Western Esplanade, Broadstairs, merchant; J. W. Reeves, 59, Ennersdale Road, Hither Green, S.E.13, clerk. Qualification, £1. Remuneration as fixed by the company.

Lilleker Brothers, Ltd. (204,082). — Private company. Registered Feburary 25th. Capital £3,000 in £1 shares. To acquire the business of electrical engineers carried on by A. Lilleker and J. Lilleker at Howard Street, Rotherham, and to carry on the same and the business of manufacturers of and dealers in instruments, accessories and materials used in connection with radio or other telegraphy or telephony, erectors of broadcasting and other stations for the distribution or reception of radio or wireless waves, &c. The permanent directors are:—A. Lilleker, Danum House, Bradgate Lane, Rotherham, electrician; J. Lilleker, Kirby Cottage, St. Stephen's Road, Rotherham, electrician; W. Lilleker, 12, Wharncliffe Street, Rotherham, electrician. Qualification, £100. Remuneration as fixed by the company. Secretary: A. Lilleker. Solicitor: L. H. Brittain, Howard Street, Rotherham.

Bergmann Electric Co., Ltd. (204,027).—Private company. Registered February 23rd. Capital, £5,000 in £1 shares. To carry on the business of electrical engineers and contractors, suppliers of electricity, electricians, manufacturers of railway, tramway, electrical and other apparatus, &c. The first directors are:—J. W. Hissink, 63, Seestrasse, Berlin, engineer; E. A. Rehder, "Melrose," College Road, Dulwich, S.E.21, solicitor. Qualification, £100. Remuneration (except managing director, if any) as fixed by the company. Solicitors: Rehder & Higgs, 29, Mincing Lane, E.C.3.

Ernest Verity, Ltd. (204,030).—Private company. Registered February 23rd. Capital, £1,000 in £1 shares. To carry on the business of manufacturers of and dealers in radio instruments of all kinds, and parts used in connection therewith, &c. The first directors are:—E. Verity, 82, Guilford Street, W.C.1, radio engineer; C. W. C. Oliver, 75, Albert Road, N.22, merchant (both permanent). Qualification, £1. Remuneration as fixed by the company. Secretary: H. R. White, 39, Wellington Avenue, Stamford Hill, N.15. Registered office: St. Andrew's Works, Dunsmure Road, Stamford Hill, N.16.

Electric and Radio Supplies, Ltd. (204,130).—Private company. Registered February 27th. Capital, £100 in £1 shares. To carry on the business of dealers in electrical and wireless apparatus, &c. The first directors are:—A. Herbert (permanent director and chairman), 50, Armour Road, Tilehurst, Reading; L. Paton, 115, Armour Road, Tilehurst, Reading. Qualification, 5 shares. Remuneration as fixed by the company. Secretary: L. Paton. Solicitors: Blandy & Blandy, 1, Friar Street, Reading. Registered office: 2, Hosier Street, Reading.

Paramount Wireless Co., Ltd. (204,146).—Private company. Registered February 27th. Capital, £500 in £1 shares. To acquire the full benefit of an agreement between P. Winocour and H. E. Thompson for the transfer to the latter by the former of all rights in patents in an invention of a permanent crystal detector for wireless operations and for payment of all fees, costs, charges, and expenses in respect thereof. The subscribers (each with one share) are:—Mildred R. Forter, 1, Station Road, Hayes, stenographer; S. F. Thomas, 70, Auchel Road, West Kensington, W.14, clerk. The first directors are not named. Secretary (*pro tem.*): H. M. Beyfus. Solicitors: Beyfus & Beyfus, 32, Sackville Street, W. Registered office: 32, Sackville Street, W.

R. E. Stitchling, Ltd. (204,148).—Private company. Registered February 27th. Capital, £1,000 in £1 shares. To carry on the business of electrical and mechanical engineers, importers, exporters, and manufacturers of and dealers in electric, magnetic, telegraphic, telephonic, radio and other appliances, &c. The first directors are:—W. E. Stitchling, 46, Parkhill Road, Hampstead, N.W.3; R. E. Stitchling, 46, Parkhill Road, Hampstead, N.W.3. Qualification, 50 shares. Remuneration as fixed by the company. Secretary: R. E. Stitchling. Solicitors: Lees, Smith, Crabb and Tetlow, 3, Berners Street, W.1. Registered office: 52, Dorset Street, Portman Square, W.1.

Official Returns of Electrical Companies.

Simmonds & Stokes, Ltd.—Issue on February 17th, 1925, of £300 second debentures, part of a series already registered.

Omega Lampworks, Ltd. — Satisfaction (*a*) in full on December 24th, 1924, of debentures dated August 26th, 1918, to December 1st, 1922, securing £3,500; and (*b*) to the extent of £500 on February 9th, 1925, of debentures dated February 4th, 1925, securing £1,500.

Particulars filed of £1,500 debentures authorised January 16th, 1925, charged on the company's property, present and future, including uncalled capital, the whole amount being now issued.

Radio Appliances, Ltd.—E. J. Bell, of 17, Queen Victoria Street, E.C.4, chartered accountant, ceased to act as receiver or manager on February 19th, 1925.

B.M.A.S., Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated February 12th, 1925, to secure all moneys due or to become due from the company to the Union Bank of Manchester, Ltd.

Sherlock Engineering Co., Ltd.—W. Hand, of 12, Cherry Street, Birmingham, was appointed receiver and manager on February 17th, 1925, under powers contained in debenture dated November 6th, 1924.

English Electric Co., Ltd.—Satisfaction to the further extent of £30,000 on December 22nd, 1924, of first mortgage debentures covered by trust deed dated September 15th, 1919, securing £1,000,000.

Never Stop Railway (Wembley), Ltd.—Sir Harry S. Foster, Kt., of 82, Victoria Street, S.W.1; W. C. Bersey, of 16, Grosvenor Gardens, S.W.1; and D. M. Anderson, C.B.E., of 85, Preston Street, Glasgow, were appointed receivers on February 18th, 1925, under powers contained in debenture dated July 2nd, 1924.

Eclat Electric Manufacturing Co., Ltd.—W. W. Jackson, of 65-66, Chancery Lane, W.C., was appointed receiver and manager on February 14th, 1925, under powers contained in trust deed dated August 10th, 1923.

City Notes.

North Metropolitan Electric Power Supply Co.

The annual meeting of this company was held on February 24th, Sir James Devonshire (chairman and managing director) presiding. In presenting the report and accounts (which were reviewed in our issued of February 27th, p. 347), the chairman said that during the past year the capital expenditure amounted to £358,000 chiefly in connection with power station improvements, main transmission lines, sub-stations, and distribution network. About 130 miles of trunk and distributing mains were laid, including about 10 miles of overhead lines, and 21 new sub-stations were put into service. The interconnection of the Hertford and St. Albans stations with the Brimsdown station was completed. Thus the interlinking between the stations was complete, with the exception of a direct line between St. Albans and Willesden, which was not vital. The Hertford and St. Albans stations would discontinue to operate as separate generating units except to relieve peak periods and for stand-by purposes. The company's Bill (*vide* "Parliamentary" in this issue) had been held over until the current session. As the objections of the Middlesex County Council had been met, there would be no opposition in Committee except on one clause, involving a question of additional protection for two railway companies. The Bill, among other things, sought to extend the company's area by about 250 sq. miles, and brought the northern limit co-terminous with the northern boundary of the County of Hereford. A Bill was being promoted for powers to supply electricity throughout the counties of Bedford, Cambridge, and Huntingdon from a station at St. Neots on the Ouse. This interested the company, as there was every possibility that, in the event of the powers being secured, the company would extend its e.h.p. mains northward to link up with those of the new company, in accordance with the policy of the Electricity Commissioners. The balance on working had improved by about 23 per cent.; this was in the same ratio as the increase in the energy sold. With the appropriation of £132,000, the reserve amounted to £420,000, but this was considered inadequate for development purposes. Mains were being laid at Potters Bar and Totteridge, and a supply would be available in those districts within the next two or three months. The company had derived considerable benefit from the British Empire Exhibition, and it had secured the contract for the whole of the requirements for this year's exhibition. The company now had nine showrooms; a new one had been opened recently at Chingford, and another was in course of erection at Southgate to take the place of the inadequate showroom already existing there. Another departure in this direction was the equipment of an "all-electric" house at Bush Hill Park, which had attracted 3,800 visitors during the six months in which it was open.

The report and accounts were adopted.

Westminster Electric Supply Corporation, Ltd.

The annual meeting was held on February 25th under the chairmanship of Lord Wargrave, who, in presenting the report and accounts (ELEC. REV., February 20th, p. 308), said that the output during 1924 had increased by about 4,700,000 kWh; this increase was divided almost equally between lighting and other purposes. Both the standard of lighting and electric cooking and heating were increasing, which augured well for the future. While the gross receipts had increased by £10,200, the costs had only risen by £2,000; this enabled the reserves to be increased and a larger amount to be carried forward. The consumers had also been considered, the price reductions amounting in the aggregate to £52,800. The technical side of their

business had been brought to a very high level, and it was the company's intention to pay more attention to the commercial aspect, while not neglecting the power station costs. There were still many unwired houses in their area which, if secured, would add considerably to the company's income, and develop a useful off-peak load. The neglect of electrical appliances was mainly due to the ignorance of consumers as to their merits, and the company was taking direct steps to bring these appliances to the notice of householders within the area.

Lord Wargrave then entered in some detail into an explanation of what the London Electricity Supply (No. 2) Bill was designed to effect. He mentioned the extension of the companies' tenure to 1971, and the limitation of prices and dividends. With regard to the latter, he thought that the arrangement arrived at was fair and equitable.

The report and accounts were adopted and, at a subsequent extraordinary meeting, resolutions were passed approving the conversion of 40,000 of the unissued preference shares into ordinary shares in order to carry out the capitalisation of the free reserves; the splitting of the £5 shares, issued and unissued, into five shares of £1 each; and the issue of the capitalised free reserves after the passing of the above-mentioned Bill.

Telegraph Construction and Maintenance Co., Ltd.

The net profit for 1924 was £111,342, and to this was added £123,159 brought forward, making £234,501. It was proposed to transfer £30,000 to reserve (making £270,000), to pay a final dividend of 7½ per cent., free of tax (making 10 per cent. for the year, free of tax, as in 1923), and to carry forward the balance of £114,861. The meeting was to be held yesterday (Thursday).

Torquay Tramways Co., Ltd.

Speaking at the annual meeting on February 26th; Mr. H. T. Barnett, the chairman, said that, considering the abnormally wet year, the results, as shown by the report (*vide* our last issue, p. 348), were good. The balance was in excess of that of 1923, but, unfortunately, the increase was nullified by additional income tax. Referring to the Babbacombe Cliff Light Railway Order, which was to be leased to the company by the Torquay Corporation, the chairman said that the railway was in the nature of an electric lift. The capital cost was £13,000, and, worked in conjunction with the tramways, the "lift" would produce satisfactory results. In conclusion, the chairman urged that the control of motor-'bus competition was necessary.

Notting Hill Electric Lighting Co., Ltd.

The report for 1924, which is to be presented at the annual meeting on March 10th, shows an available profit of £92,545 (including £23,925 brought forward). Note and debenture interest, income tax, contingencies fund, and sinking funds absorb £20,526; £15,000 is transferred to the depreciation, renewal, and reserve fund; and £3,000 to the special reserve, leaving £54,019. After allowing for the interim dividends, paying the final preference dividend, and distributing £1,386 to the staff under the co-partnership scheme, a final dividend at the rate of 10s. per share, free of tax, is paid on the deferred shares, leaving £23,568 to be carried forward.

To meet the increased demand, an agreement has been entered into for a supply from the Central Co.'s station at Grove Road, and the necessary junction mains have been laid. The report, in common with those of the other London companies, makes reference to the London Electricity Supply (No. 2) Bill and to the proposed London joint electricity authority.

Kensington and Knightsbridge Electric Lighting Co., Ltd.

The directors' report for 1924 shows a net profit of £24,747. After adding the sum of £13,374 brought forward, and deducting interim dividends, there remains a balance of £29,496, which it is proposed to distribute as follows:—Remainder of preference dividends, £2,125; final dividend of 10s. per share on the ordinary shares, making 15 per cent. for the year; carried forward, £16,871. The renewal and reserve fund balance now stands at £142,882, of which £106,749 is the amount expended in excess of capital received.

Reference is made in the report (as in other reports) to the London Electricity Bills and the proposed joint electricity authority. The meeting was to be held yesterday (Thursday).

London Electric Supply Corporation, Ltd.

This company's report was reviewed in our last issue (p. 347). The annual meeting was held on February 25th, when Mr. R. H. Benson, who presided, said that in spite of the large reductions made in the charges to consumers, the gross revenue had increased by £30,387. The reduction of the cost of production from 1.05d. to 0.97d. per kWh had enabled them to increase the gross profit by £10,400. The extensions at the Deptford power station had made considerable progress during the year; 80,000 h.p. was being added to the present plant. A large amount of that additional power would be utilised during the current year as the various stages of the Southern Railway electrification were put in commission. Early in the current year they hoped to give an additional supply to the Brighton section, and the first electrified portion of the South-Eastern section was due to be opened in July next. This would enable them to reduce their costs of production and thereby give a cheaper supply to the public. Further land adjoining the Deptford station had been acquired for extensions, and the ultimate result would be that this station would be one of the largest in the country. Mr. Benson paid a tribute to the efforts of the staff in carrying on the ordinary supply during the progress of the extensions. The chairman then dealt with the London Electricity Supply (No. 2) Bill which, he contended, was in the best interests of both the company and the public. In conclusion, he mentioned that the works at Deptford had been the means of employing between 1,000 and 1,500 men, tending towards the reduction of unemployment as well as the cheapening of electricity for all purposes.

Underground Electric Railways Co. of London, Ltd.

The directors' report for the past year shows total receipts of £793,807 and an expenditure of £89,916, leaving net receipts of £703,891, a reduction of £30,772 as compared with the 1923 figure. Income tax and debenture interest absorb £521,114, and a balance of £95,639 is brought forward, leaving £616,753. After paying the interest due on the 6 per cent. income bonds, a balance of £126,685 is carried forward. The loss on exchange was reduced to £31,134, and it is expected that a further reduction will be shown in the next accounts.

The report reviews the financial results of the operating companies, and the improvements carried out by them. These matters were dealt with in our issue of February 20th, p. 307.

Representations were made to the directors by some of the unassented ordinary stockholders of the Central London Railway that their holdings have a very restricted market and are difficult to dispose of. Consequently the directors made arrangements for the exchange of the stock, where desired, for guaranteed assented stocks constituted under a trust deed dated December 13th, 1912. Holders of a total amount of £260,987 of ordinary stocks took advantage of the offer. The meeting was to be held yesterday (Thursday).

Steyning Electric Light Co., Ltd.

At the annual meeting, held on February 27th, Mr. G. A. Flowers, who presided, said that the trading continued steadily to increase. Following the loss sustained last June by the death of Mr. E. Prior, the engineer and managing director, Mr. C. A. Rhoades, a local engineer, was appointed engineer-in-charge in August. Owing to the growth of the business, the purchase of a larger plant would be necessary in the near future. The report for the year 1924 showed that the income from the sale of electricity exceeded £2,000. After carrying £370 to depreciation and paying a 5 per cent. dividend, £104 is carried forward.

Melbourne Electric Supply Co., Ltd.

The *Financial Times* reports that the accounts for the year ended August 31st last are expected to show a balance of £414,071, as compared with £344,188 in the previous year. After providing for debenture and gold bond interest and sinking funds, the balance is £314,922, to which is added £26,999 brought forward. After the payment of preference and ordinary (10 per cent. for the year) dividends, £130,000 is transferred to general reserve, £50,000 to the income tax reserve, £10,000 to reserve for staff-retiring allowances, and £8,524 to the loan-redemption account, leaving £23,336 to be carried forward.

Philips Lamps, Ltd.

We are informed that the first meeting of this company was held at the registered office, 60, Wilson Street, E.C.2, on February 25th. Mr. A. F. Philips, managing director of Philips Glowlampworks, Ltd., Eindhoven, Holland, and Mr. S. R. Mullard, managing director of the Mullard Radio Valve Co., of London, S.W.12, were appointed directors of the company; Mr. D. C. F. Van Eendenberg, and Mr. A. de Jong, were appointed joint general managers; while Mr. W. T. E. Blunden was appointed general sales manager, and Mr. W. G. Lund, secretary.

China and Japan Telephone Co.

Hong Kong Telephone System.—A *Reuter* dispatch from Hong Kong (March 2nd) states that an agreement has been reached whereby a local company with a capital of $5,000,000 is to take over the local telephone system from the China and Japan Telephone Co. as from July 1st next. The consideration will be the allocation of 140,000 fully-paid shares of $10 each in the new company and a cash payment of $67,591. This agreement is subject to the approval of the Hong Kong Government, the shareholders of the China-Japan Telephone Co., and the promoters of the new company, which is considered certain.

Liverpool Overhead Railway Co.

The annual general meeting of the company was held on February 26th. Mr. G. D. Killey, the chairman, in moving the adoption of the report, said that the train mileage in 1924 was 767,535, against 851,943 in 1913, but in spite of this considerable decrease, wages had increased to £71,458 from £27,571. On the other hand, the gross revenue had increased by £34,951 only, as compared with 1913. During 1924 the system carried nearly half a million fewer passengers than in 1923. The total receipts for the year were £124,743, and the expenditure was £117,548, leaving a balance of £7,195, which, with other amounts, was sufficient to pay the full year's dividend of 5 per cent. on the preference shares and to carry forward £5,689. The tramway lease with the local authorities of Waterloo and Crosby expired at the end of the year, and he hoped, as the outcome of conversations which had taken place with regard to a renewal of the lease, that there would soon be a settlement equitable to both sides. Mr. James Kelly complained that for four years the ordinary shareholders had had no return on their money. He

found that for the past three years the company's supply of power had cost 1.09d. per kWh, yet the Liverpool Corporation was willing to supply large power users at .8d. per kWh, and he asked why the directors did not secure a long term agreement with the Corporation. He further contended that the company's generating plant, which had been in use since the railway was first operated, was now obsolete, and ought to be scrapped. Mr. J. P. McKenna said that the directors should consider the desirability of scrapping the generating plant and getting a supply from the Corporation or the L.M. and S. Rly. Co. The Chairman said that with regard to electricity supply, the directors had already been in touch with the Liverpool Corporation. The report was adopted, and when a motion was proposed to pay the 5 per cent. preference dividend, it was opposed, but was carried by a small majority. Thereupon several shareholders demanded a poll of both preference and ordinary shareholders, and this was fixed to be taken on March 12th, to which date the meeting was adjourned.

French Electrical Companies.

In order to meet the increasing demand for current in the coal mining district of the Nord and Pas de Calais departments, the *Société Bethunoise d'Eclairage et d'Energie Electrique* is increasing its capital from 15 to 30 million francs. Subscriptions are being invited for 150,000 new 100 franc shares, which are being offered at 150 francs each.

The Société Pyrenéenne d'Energie Electrique, of Paris, is increasing its capital to the extent of 5,000,000 fr. by the issue of 10,000 new 500 fr. shares, which are being offered for subscription at 600 fr.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 159 :—

North British Aluminium Co.—£2,500,000 4½ per cent. guaranteed debenture stock, 1931-55, issued at £96½ per cent., partly and fully paid.

Stanton Ironworks Co.—£1,000,000 4½ per cent. guaranteed debenture stock, 1931-45, issued at £96½ per cent., partly and fully paid.

Sudan Construction and Equipment Co.—£540,000 4½ per cent. guaranteed debenture stock, 1931-45, issued at £96½ per cent., partly and fully paid.

Llanelly and District Electric Supply.—£200,000 5 per cent. first mortgage debenture stock. 40,000 6 per cent. cumulative preference shares of £1 each, fully paid, Nos. 450,001 to 490,000.

Marconi's Wireless Telegraph.—500,000 new ordinary shares of £1 each, issued at £1 7s. 6d. per share, partly and fully paid, Nos. 3,500,001 to 4,000,000.

The undermentioned have been ordered to be officially quoted :—

Llanelly and District Electric Supply Co.—40,000 6 per cent. cumulative preference shares of £1 each, fully paid, Nos. 450,001 to 490,000.

South Wales Power Co.—250,000 6½ per cent. cumulative preference shares of £1 each, fully paid, Nos. 1 to 250,000.

National Gas Engine Co., Ltd.—The report for 1924 shows a profit of £22,398, plus £18,149 brought forward. After paying 5 per cent. on the preference shares and 2½ per cent. on the ordinary, both less tax, £13,547 remains to be carried forward. During the year the directors concluded a satisfactory arrangement with Messrs. Kynoch, Ltd., to take over the gas and oil engine business of the latter. That business has been carried on successfully at home and abroad for a long period.

Belgian Electrical Company.—A somewhat novel method of capital increase has just been adopted by the *Société d'Electricité du Brabant*, of Brussels, applications being invited for 8,000 500-fr. preference shares, 20 per cent. paid up, and 8,000 new ordinary shares of no declared value, which are being offered for subscription at 795 fr. for one preference and one ordinary share.

Mansfield and District Tramways, Ltd.—The 18th ordinary general meeting of the company was held on February 27th, Mr. A. H. Holland presiding. In moving the adoption of the report and accounts, the chairman stated that the company was able to maintain the dividend on the ordinary shares, after providing a substantial sum for the reserve fund.

Electro Bleach & By-Products, Ltd.—The report for 1924 shows a profit of £48,490, plus £3,291 brought forward. After paying 10 per cent. for the year on the preference shares and 20 per cent. on the ordinary (both subject to deduction of tax), £10,000 is put to reserve and £1,781 is to be carried forward.

Bournemouth and Poole Electricity Supply Co., Ltd.—The directors recommend a final dividend of 5½ per cent. on the ordinary shares, making 10 per cent. for the year, together with a bonus of 4 per cent.. In the preceding year the dividend was the same, but the bonus was only 3 per cent.

City of London Electric Lighting Co., Ltd.—The directors recommend a final dividend of 2s. per ordinary share, making 15 per cent. for the year, as in 1923. £170,000 is transferred to reserve (as against *nil*), and about £36,500 carried forward (£33,482).

Italian Electrical Company.—The *Società Italiana per Imprese Elettriche "Dinamo,"* of Milan, is increasing its capital to the extent of 7,500,000 lire, and is inviting subscriptions for 75,000 shares of 100 lire at 102 lire each.

Brompton and Kensington Electricity Supply Co., Ltd.—Final dividend on the ordinary shares at rate of 10 per cent. per annum (free of tax), making 10 per cent., carrying forward £4,982.

Brazilian Traction, Light and Power Co.—Quarterly dividend of 1½ per cent. on the cumulative preference shares.

Stocks and Shares.

MONDAY EVENING.

STOCK Exchange markets have been disturbed by an unexpected flurry in money rates. Unexpected demand in America caused a rise in the New York Bank rate. Some people thought that the Bank Rate here might rise to-day (Monday), or on some day earlier than the conventional Thursday. Investment and speculation alike were attacked by a fit of the shivers, and in some directions heavy selling ensued. This has not influenced, appreciably, the prices in such quiet markets as those for electricity supply shares, but its effect is felt more indirectly in the restriction of willingness on the part of investment to embark capital at a time when the money outlook is cloudy. A 5 per cent. bank rate might alter the focus for investment values, and after enjoying a 4 per cent. minimum for over eighteen months, the Stock Exchange and the money market view with dislike the possibility of a change.

Nearly all the companies in the London electricity supply group have declared their dividends. This enables, *inter alia*, our price-tables to be brought up-to-date, and it will be observed that the yields on the money show an average of about 5¼ per cent. County ordinary pay the least of the group, namely, 5¼ per cent., while from Westminsters, Kensingtons, Chelseas, Charing Cross and City of London, the yields range from 6¼ per cent. to 6½ per cent. on the money. County of London ordinary reacted from the best, owing to the failure of the company to pass its Bill in Parliament for extending its operations over the whole of Essex. As is generally known, the County company already possesses powers over part of the county, but the Bill sought a large extension of area, and good deal of local opposition was aroused.

Westminsters fell 10s. to 11¼ upon a little profit-taking. Why the shares should be the subject, more than others, for mild speculation, it is difficult to say, but the fact remains. Lord Wargrave, at the company's meeting last week, gave a very interesting review of the position as it now stands for the London supply companies. Metropolitans are rather harder. Clyde Valley rose 2s. Urbans strengthened to 19s. 6d., the preference to £1. Bournemouths are 1/16 lower.

Home Railway stocks are flat throughout the list. The Undergrounds have suffered with the rest. Metropolitans and Districts are both down 1¼. Underground Electric £10 shares fell 5s. to 2½. The market showed no resistance to a heaviness produced by the Labour outlook, and by some melancholy reflections made thereon by chairmen of the steam companies at the recent meetings. Investors are weary of their holdings, and, seeing no immediate prospect of improvement, are selling these in order to utilise the money in the purchase of some of the more popular industrials which have come to the front.

Amongst these may be noted several of the principal cable manufacturing shares. Substantial demand sprang up, and suddenly, for British Insulated, Callenders, Henleys, Johnson and Phillips, Siemens, India Rubber shares and some of the others. The dealers were taken by surprise. There was little stock on hand to meet the demand, and prices had to be put up abruptly. In some cases it is doubtful whether the rise is not being over-done. The Siemens dividend is expected to be 10 per cent., or double that of a year ago. Johnson & Phillips, whose shares have spurted 3/16 to 31s. 3d., are considered likely to pay anything between 7½ and 12½ per cent.; possibly the middle estimate, 10 per cent., will turn out to be a fairly reasonable one. The buying discounts a good deal of future prosperity, but there is no denying the character of what can only be called a persistent and a strong movement which should not be termed speculative, inasmuch as the shares will be taken up, in most cases, by those who have been buying them within the past week. Engineering shares keep their values, Babcock & Wilcox remaining at 56s. 3d. Edisons rose 9d. to 7s. 9d. and General Electric preference to 24s.

Amongst some of the more arresting movements of the week is a rise of four points in Uxbridge and District debenture, which has taken the price to 95½, River Plate Electric 6 per cent. preference at 101 is 3 points higher, Mexican Light and Power preferred gained 2½ at 63, while a fall of similar amount lowered British Columbia deferred to 111. Argentine Light and Power ordinary are better at 12s. The Anglo-Argentine Tramways group is unchanged.

Dealings began to-day (Monday) in the new shares just issued by Marconi's. It will be recalled that the holders of the ordinary and preference shares have the right to subscribe for one new Marconi ordinary at 27s. 6d. in respect of every six old shares held. The price of the new began at 6s. premium, but shaded off to 5s. 4½d. premium, in sympathy with a decline from 35s. 6d. to 33s. 9d. in Marconis themselves. Canadian Marconis touched 6s. 1½d. before reverting to 5s. 7½d. Western Telegraphs rose to 17½, and the cable group as a whole is firm, holding its previous improvements. United River Plate Telephones put on 3s. 9d., advancing to 6 15/16. Oriental Telephones are better at 2 3/16. Great Northern Telegraphs are 20s. up at 32½, following upon their rise of 12s. 6d. last week. Automatic Telephones, after being 31s. 6d., recovered to 33s. 9d. The market in the medium-priced shares, as well as in those of the cable manufacturing issues already mentioned, exhibits a condition of activity very different from its usual staid appearance.

Rubber shares are at length responding to the improvement in the price of the raw material, and to the state of the statistical position. Rubber is up to 1s. 7d. per lb. Share prices are moving upwards and more general attention is thereby attracted to the market. Business, however, remains of modest dimensions.

Share List of Electrical Companies.

	Nom. £	Dividend. 1923.	1924.	Price Mar. 2. 1925.	Rise or fall.	Yield. p.c.
Home Electricity Companies.						
Bournemouth and Poole ...	1	13	14	2⅝	— 1/16	5 1 10
Brompton Ordinary	1	10	10	1⅝	—	*5 6 8
Charing Cross Ordinary	1	14½	15	47/-	—	6 7 7
do. do. do. 4½ Pref.	1	4½	4½	17/6	—	5 2 10
Chelsea	1	12	12	37/6	—	6 8 0
City of London	1	15	15	49/-	—6d.	6 2 6
do. do. 6% Pref. ...	1	6	6	23/6	—	5 2 2
Clyde Valley	1	8	8	30/-	+2/-	5 6 8
County of London	1	15	15	55/-	—9d.	5 8 6
do. do. 6% Pref. ...	1	6	6	23/6	—	5 2 2
Edmundson's Ordinary	1	7	—	21/-	—	6 13 4
do. 7% Pref.	1	6	—	23/-	+6d.	6 1 9
Elec. Supply Corporation ...	1	10	10	27/-	—	7 8 2
Kensington Ordinary	5	14	15	11½	—	6 10 5
Lancs. Light and Power ...	1	7½	7½	27/-	—	5 11 1
London Electric	1	10	10	36/6	+6d.	5 9 7
do. do. 6% Pref. ...	5	6	6	5⅝	—	5 9 1
Metropolitan	1	10	—	38/-	+6d.	5 5 3
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	5⅞	6	24/-	—3d.	5 0 0
Newcastle-on-Tyne Ordinary ...	1	6	6	23/-	—2/3	5 4 4
do. 5% Pref. ...	1	5	5	18/9	—	5 6 8
do. 7% Pref. ...	1	7	7	25/-	—	5 12 0
Notting Hill 6% Pref.	10	6	6	9⅞	—	6 4
North Met. Elec. 6% Pref. ...	1	6	6	1⅛	—	5 6 8
St. James' and Pall Mall ...	5	17½	17½	13⅜	+ ⅛	6 10 10
South London	1	15	15	2⅞	—	5 17 0
South Metropolitan Pref. ...		7	7	1¾	—	5 12 0
Urban Ordinary	1	4	—	19/6	+9d.	4 2 1
do. 6% Pref. ...	1	6	—	1	+6d.	6 0 0
Westminster Ordinary	5	15	15	11½	— ½	6 14 8
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	1	—	7 10 0
Yorkshire Elec.	1	8	8	29/-	—	5 10 4
Home Rails.						
Central London Ord. Assented	Stock	4	4	73xd	—	5 11 1
Metropolitan	,,	4	5	81	—1½	6 3 3
do. District	,,	3½	3½	51	—1½	6 17 4
Underground Electric Ordinary	10	Nil	Nil	2⅜	— ⅛	Nil
do. do. "A" ...	1	Nil	Nil	8/-	—6d.	Nil
do. do. Income	Bonds	6	6	98xd	—1	*6 9 5
Telegraphs and Telephones.						
		Dividend. 1922.	1923.			
Anglo-Am. Tel. Pref.	Stock	6	6	104½	—	5 14 10
do. Def.	,,	1½	1½	23⅞	—	6 6 4
Automatic Telephone	1	Nil	3	1 1/16	+ 1/16	1 15 6
Chili Telephone	5	6	6	5⅞	—	*5 4 4
Cuba Sub. Ord.	10	7	7	7½	—	9 13 2
Eastern Extension	10	10	10	17⅞	—	*5 12 8
Eastern Tel. Ord.	Stock	10	10	17 5/16	—	*5 14 0
Globe Tel. and T. Ord.	10	10	10	18	—	*5 11 1
do. do. Pref.	10	6	6	11½	—	5 7 10
Great Northern Tel.	10	24	22	32½	+1	6 17 0
Indo-European	25	7	7	9⅜	—	*5 6 1
Marconi	1	15	10	1 1/16 xr	—	5 18 6
Marconi Marine	1	10	10	1⅛	—	8 17 10
Oriental Telephone Ord. ...	1	12	12	2 3/16	+ 1/16	*5 9 7
United R. Plate Tel.	5	8	8	6 1/16	+ 1/16	*5 15 6
Western Telegraph	10	10	10	17½	+ ½	*5 14 8
Home and Foreign Trams, &c.						
Anglo-Arg. Trams First Pref. ...	5	12½	5½	8½	—	8 9 2
do. do. 2nd Pref. ...	5	5½	6	3 1/16	—	9 16 0
do. do. 5% Deb. ...	Stock	5	5	70½	—	6 10 9
British Electric Traction Ord. ...	,,	5	6	101½	—	5 18 3
do. do. 6% Pref. ...	,,	6	6	106½	—	5 13 9
Brazil Traction	100	4	4	57	—	7 0 4
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	92¼	—	5 8 1
do. do. Preferred	,,	5	90/-	91½	—1	*5 4 8
do. do. Deferred	,,	8	129/5	111	—2½	*5 16 8
do. do. Deb.	,,	4½	4½	81½	—	5 4 4
Lond. & Sub. Trac. 5% Pref. ...	1	5	2½	5/6	—	Nil
London United Tram. Deb. ...	Stock	4	4	51½	—	7 15 4
Mexico Trams, 5% Bonds ...	—	Nil	5	7⅜	—	6 19 0
Mexican Light Common ...	100	Nil	Nil	25	—	Nil
do. Pref.	100	Nil	Nil	63	9½	Nil
do. 1st Bonds ...	—	5	5	62½	+1½	7 6 0
Yorkshire (West Riding) ...	1	—	5	1 1/16	—	4 14 0
Manufacturing Companies.						
Babcock & Wilcox	1	20	12	16/3	—	*4 5 3
British Aluminium Ord.	1	5	5	32/-	—	3 9 6
British Elec. Transformer Pref.	1	Nil	Nil	17/6	—	... ...
British Insulated Ord.	1	15	15	3½	+ ½	4 16 0
Brush Ord.	1	10	10	24/6	—	8 3 4
Callenders	1	15	15	3⅜	+ 1/16	4 12 4
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	5	Nil	⅛	—	... ...
Edison-Swan	4/-	7½	10	7/9	+9d.	5 3 3
do. 5% Deb.	Stock	5	5	81½	—	6 0 3
Electric Construction	1	10	10	32/6	—	6 3 1
Enfield Cable, Pref.	1	7½	7½	1½	—	6 0 0
English Electric	1	8	5	20/3	—	4 18 9
do. do. Pref.	1	6	6	21/6	—	5 11 7
Gen. Elec. Pref.	1	6½	6½	24/-	+9d.	5 8 4
do. Ord.	1	5	5	22/3	—	4 10 0
Henley	1	15	15	3½	+ ⅛	4 12 4
do. 4½% Pref.	5	4½	4½	4 1/16 xd	—	5 6 0
India-Rubber	1	10	5	19/6	+2/-	*5 2 7
Johnson & Phillips	1	5	5	1 1/16	+ 1/16	3 4 0
Met-Vickers, Ord.	1	12½	8	1½	—	6 8 0
do. Pref....	2	8	8	2½	—	6 8 0
Siemens Ord.	1	5	—	1 1/16	+ ⅛	3 16 2
Telegraph Construction	12	20	20	27½	—	*4 7 0

* Dividends paid free of Income Tax.

Market Quotations for Chemicals and Metals.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

CHEMICALS, &c.	Price Mar. 2.	Fortnight's Inc. or dec.
a Acid, Oxalic ... ... per lb.	5½d.	...
a Ammoniac, Sal ... ... per ton	£60	...
a Ammonia, Muriate (large crystal) ,,	£52	...
a Bisulphide of Carbon ... ... ,,	...	...
a Borax ... ... ,,	£25	...
a Copper Sulphate ... ... ,,	£25 10s.	...
a Potash, Chlorate ... ... per lb.	4d. to 4½d.	...
a ,, Perchlorate ... ... ,,	5½d.	...
a Shellac ... ... per cwt.	£15 15s.	...
a Sulphur, Sublimed Flowers ... ,,	£7 15s.	...
a ,, Roll ... ... ,,	£7 15s.	...
a Soda, Chlorate ... ... per lb.	9d.	...
a ,, Crystals ... ... per ton	£5 to £5 5s.	...
a Sodium Bichromate, casks ... per lb.	4d.	...
METALS, &c.		
b Aluminium, Ingots ... ... per ton	£120 to £125	...
b ,, Wire ... ... per lb.	1/9 to 2/0*	...
b ,, Sheet ... ... ,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—		
Grade I ... ... per ton net	£232	£10 dec.
Grade II ... ... ,, ,,	£168	£6 dec.
Grade III ... ... ,, ,,	£98	£3 dec.
c Brass (rolled metal 2" to 12" basis) per lb.	10½d.	...
c ,, Tubes (solid drawn) ... ,,	1/0½ to 1/0½	...
c ,, Wire, basis ... ... ,,	10½d.	...
c Copper Tubes (solid drawn) ... ,,	1/1½	...
c ,, Bars (best selected) ... per ton	£95	...
c ,, Sheet ... ... ,,	£95	...
c ,, Rod ... ... ,,	£95	...
d ,, (Electrolytic) Bars ... ,,	£69	25/- dec.
d ,, ,, Sheets ... ,,	£148 10s.	...
d ,, ,, Wire Rods ,,	£79	2/- dec.
d ,, ,, H.C. Wire per lb.	9½d.	½d. dec.
f Ebonite Rod ... ... ,,	2/- to 3/6	...
f Sheet ... ... ,,	2/- to 3/6	...
a German Silver Wire ... ... ,,	2/3	...
h Gutta-percha, fine ... ... ,,	8/6	...
h India-rubber, Para fine ... ... ,,	1/5½	½d. inc.
i Iron Pig (Cleveland Warrants) ... per ton.	£5 2s. to £5 2s. 6d.	...
i ,, Wire, galv. No. 8, P.O. qual. ,,	£23	...
g Lead, English Pig ... ... ,,	£39	10/- inc.
g Mercury ... ... per bot.	£12 5s. to £12 10s.	...
e Mica (in original cases) small ... per lb.	3d. to 8/-	...
e ,, ,, medium ,,	4/- to 8/-	...
e ,, ,, large ... ,,	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings ,,	1/9½	...
p ,, ,, drawn bars & rods ,,	1/8	...
p ,, ,, rolled strip & sheet ,,	1/9½	...
p ,, ,, wire ... ... ,,	1/4	...
e Platinum ... ... per oz.	£26	...
d Silicium Bronze Wire ... ... per lb.	1/6½	½d. dec.
r Steel, Magnet, in bars ... ... ,,	7½d.	...
a Tin, Block (English) ... ... per ton.	£252 to £252 10s.	£11 10s. dec.
n ,, Wire, Nos. 1 to 16 ... ... per lb.	4/3	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Mathey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

The Newcastle Electric Supply Co.'s Progress.—We have received a copy of "A Great Undertaking" from the Newcastle-upon-Tyne Electric Supply Co., Ltd. It is a beautifully illustrated pamphlet of 28 pages descriptive of the electricity undertaking, its history and growth, its generating stations and plant, and its distribution system and area, &c.

The publication of the booklet is the result of an effort to break down the English tendency to underestimate our national achievements in comparison with those of other nations, and to prove the company's claim to have an electricity undertaking as efficient and up-to-date as any in the world.

A map of the Tyne and Wear area shows the 1,400 square miles supplied by the undertaking at present and a table is given showing the growth of this area from 1890, when it was only 11 square miles, to the present-day figure. Mention is made of the services rendered during the war and it is interesting to note that the whole of the very extensive plant put in to meet the "war" load is now in full commission for the purposes of normal business. The largest motor on the system is one of 20,000 h.p., which is thought to be the largest electric motor in the world. The cable network consists of 1,200 miles of mains and there are over 500 sub-stations in the area. It is also interesting to note that the entire system is directed from one control room situated at the Carville Power Station.

The undertaking supplies 160 collieries, and the quantity of electricity sold by the company and its associated companies during last year represented one-eighth of the total sold by all authorised electricity undertakings throughout the United Kingdom.

The pamphlet is concluded with diagrams illustrating the relative quantities of electrical energy generated at the various stations, the relative costs in various directions, how the power is used and the capital employed.

Industrial Power Installations.

By C. T. PAYN.

The planning of industrial power installations requires careful consideration of many details, and a complete knowledge of all systems of electric power distribution which are in common use. Before making an estimate of the cost of wiring and equipment for an industrial plant, a set of wiring plans showing the method of distribution to all parts of the building, location of main switchboard (or service switch), building risers, and distribution centres is essential. The floor plans should show all branch lines for supplying motors, starters, and controllers. The details of their installation can be given on the specification, but it is impossible to put more than the barest detail on the plans, and it will therefore be necessary to draw up a complete set of specifications which will contain all details of switchboard equipment, switches, starters, motors, wire, conduit, and distribution boards, &c.

The location of the building risers and distribution centres is all-important, and should receive the most careful consideration. Motor drives should be laid out on the floor plan, so that the possible load centres can be found as nearly as possible.

The cost of operation is governed to a great extent by the method of grouping machinery on the floor. This, however, is limited by the sequence of operations which must not be disturbed. Where there is a large number of similar machines, these can be grouped, each group being driven by its own motor from a main line shaft. This is particularly suitable in the case of automatic lathes, punch presses, drilling and tapping machines, &c., where the machines are in constant operation. Such machines as screw-presses, air-compressors, fans, blowers, pumps, conveyors, &c., which must be located where space is available, should each have a separate motor.

A close study of local conditions, general arrangement of machinery, service (continuous or intermittent), location of driving motors (floor or ceiling), cost of power, first cost of installation, maintenance, &c., is necessary to intelligently plan a power installation.

Careful selection of motors to be used is all-important to the economic running of machinery. All machine tools of any reputable make are tested at the factory, and the manufacturer will furnish technical data as to the power required, nature of load, speed, and best method of control; and this information will render the selection easy. In the case of old machines, a test motor should be installed and readings taken of the power required to start and run the groups of machinery. With regard to the choice of machines, it is surprising to notice the indifference of most power users as to whether the machines they buy are efficient or not. Upon the choice of machines depends 90 per cent. of the success of the installation. Few appear to realise what a 2 per cent. higher efficiency motor means. To save a few pounds on a motor by buying one only 2 per cent. less efficient is "penny wise and pound foolish," because at the present cost of electric power, the more efficient motor will have *actually* paid for itself, in its saving of power, in a few years. As an example, take the price of a 10-b.h.p. motor, with an efficiency of 90 per cent. at ¾ load, at £33 10s., and that of a similar motor with an 85 per cent. efficiency at the same load at £29. Then with electricity at 1½d. per unit the relative running costs per annum for a 48-hour week will be:—

$10 \times 746 \times 48 \times 50 \times 1.5/1{,}000 \times .90 \times 240 = £124.3$
90 per cent. efficiency.

$10 \times 746 \times 48 \times 50 \times 1.5/1{,}000 \times .85 \times 240 = £131.7$
85 per cent. efficiency.

This means a saving of £7.4 per annum, which would pay for the higher efficiency motor in a little under five years, while the saving on the first year would more than pay for the difference in first cost.

A real saving can be effected in the installation of high-efficiency squirrel-cage motors wherever possible. They are cheaper than slip-ring motors, and if anything more efficient, while the starting gear is more simple, less costly, and the breakdown risks and maintenance costs are less. It must be borne in mind, however, that an induction motor with a permanently short-circuited rotor (which involves low rotor resistance) cannot have *both* high efficiency and high starting torque. Such motors are therefore incapable of starting against heavy loads without the insertion of a starting resistance in the rotor circuit, yet I have seen manufacturers specify their motors to have "high efficiency and high starting torque, with permanently short-circuited rotors." Some manufacturers introduce a resistance into the rotor circuit by high resistance end rings, but though this may increase the starting torque, the results are lower speed, lower power factor, and lower efficiency. The choice of a direct-current motor is not so difficult, and owing to their having been longer in use they are better understood. The choice rests chiefly between shunt-wound interpole motors with hand starters, and compound-wound interpole machines, and in special instances shunt or compound-wound adjustable speed motors with field control. It is not proposed in this article to enter into a discussion on the various merits and otherwise of a.c. and d.c. motors for industrial purposes. Each has its own special field of use, but where a three-phase a.c. supply is given (and except in a few isolated cases this is the generally accepted supply) the a.c. motor is the only reasonable proposition.

A vital point which is often considered as outside the scope of an electrical installation is the size of the pulley to be fitted. This is all very important, and no engineer should undertake an installation unless he is allowed the primary say as to the size of pulley to be fitted.

The motor manufacturer regularly gets requests to fit smaller pulleys than are capable of transmitting the full power developed by the motor, and the power wasted at the pulley alone often varies between 5 and 20 per cent.

In selecting the correct size of pulley, a few simple calculations will suffice. These will be necessary in any case in determining the best motor speed for the drive. The calculations can be made from the following formula: $d = D \times S/s$ where:—

d = diameter of driving pulley.
s = speed in r.p.m.
D = diameter of driven pulley.
S = speed of driven pulley.

To determine the size and speed of gears using the proper formula, substitute the number of teeth in the gear for the diameter of the pulley.

After the proper motor has been selected, the method of drive must be decided on, and this will depend largely on the nature of the load.

If the knowledge has not already been acquired, it is advisable to study the subject of factory power from books devoted entirely to that subject, of which there are quite a number. The most common methods are belt drives, gear, couplings (rigid and flexible), chain, and rope drives.

Perhaps a word here with reference to line shafting is not inappropriate. The installation of line shafting too small in diameter, using plain instead of oil ring, or ball type bearings, adds considerably to the waste of power. As much as 20 per cent. can easily be saved by efficient shafting. Belt drives are often too short and consequently excessively tight. This type of drive, with the addition of belt dressing, will vary the power

users' loss far more than he is capable of doing with the purchase of a motor. The claims of anti-friction bearings, the merits of slack belt drives, the use of clutches to disconnect temporarily unused lines of shafting, the use of efficient speed reducing gears in place of numerous countershafts, and other means of reducing transmission losses should, and must be, thoroughly investigated. In order to provide a given power at a tool, that power plus sufficent to compensate for all the incidental losses in transmission must be generated. Consequently although much of the foregoing is generally accepted as being beyond the province of the electrical engineer, it is obvious that he should have a considerable amount of influence in this direction if the installation is to be anything like an efficient one.

The ultimate efficiency attainable is of course circumscribed by the necessity to use existing equipment, and is governed by the previous choice of plant and system, but this does not absolve the engineer from striving to make that ultimate efficiency as high as possible.

The following is a brief indication of the various drives to be considered.

Belt drive is common in factories, where groups of machines are driven from countershafts, it being easy to install and maintain, and flexible belt drives should always be used for driving ammonia and air compressors, fan blowers, &c., unless conditions warrant a special connection.

Gear drive is often used where space or the nature of the load renders belt driving impracticable.

Direct drive may be used where the load is steady and the motor speed corresponds to that of the driven shaft; as in the case of motor-generator sets, rotary pumps, &c.

Chain drive is particularly useful where the motor cannot be installed in the proper position for gearing, and where space limitations prevent a belt drive.

Proper motor control equipment is essential. A motor can be used for a number of different operations by selecting the correct apparatus, which should be of a robust nature, fool-proof, and as simple in operation as possible, preferably ironclad gear. The whole satisfactory operation of the plant and factory in the future may well depend on the careful and thoughtful selection of the correct controlling devices. For all motors over 5 h.p., overload and no-volt coils should be fitted. The extra cost is little, and they save endless trouble later.

The motor foundations are often included in a contract for a complete electrical installation. Motors of 50 b.h.p. and over should be erected on concrete. This cost will depend upon working conditions, and will include excavations, disposal of dirt, wood forms, foundation bolts, sleeves, washers, wood templates, sand, cement, crushed stone, mixing, pouring, finishing and removal of forms.

Small motors may be bolted direct to the floor, but it is advisable to use wood timbers under the slide rails or base. If there is much of this work to do, it should be sub-contracted to a builder and an individual estimate obtained.

The installation should consist of standard equipment throughout. Motors particularly should be interchangeable so far as is compatible with high efficiency.

One or two motors (depending on the size of the installation), together with the necessary controlling gear, should be kept in reserve. Standard motors, equipment, &c., can only be arrived at after a comprehensive survey of the whole situation, and lastly, due regard must be paid to the Home Office Factory Regulations and underwriters' requirements. It is not sufficient to work only to the Home Office regulations; there are quite a number of rules to be observed in connection with fire risks which do not come within the scope of the regulations, and which concern the insurance companies only.

Wireless and the Solar Eclipse.

By ARTHUR E. COTTERELL.

Whilst it was certainly desirable that advantage should be taken of the recent eclipse, in the hope of extending knowledge concerning the conditions which affect wireless, it is possible that some exaggerated importance has been attached to the opportunity afforded and the results obtained. As to the latter, there have been reports of improved broadcast reception, including the hearing of distant stations in America and elsewhere which are not usually heard in the daytime. There is also the very interesting report of tests as to signal intensity and bearings which appears on page 214 of the Electrical Review for February 6th, as to all of which I have something to say.

It is, of course, well-known that the range and strength of wireless waves are greater during the night than in the daytime, and that winter is more favourable to their propagation than summer, the explanation being advanced that the solar rays ionise the atmosphere, thereby rendering it less suitable for the conveyance of electric waves; hence it follows that advantage arises at night when solar rays are absent from that particular side of the earth, and in winter when the sun attains a lower altitude in the daytime.

Considerations such as these naturally suggested that the obscuration of solar rays during the recent eclipse presented a somewhat rare and favourable occasion for further investigation of the subject.

As, however, the eclipse was not total in this country, it would appear that any local tests were shorn of much of their possible value. Whilst it is conceivable that some improvement may have been noticed in broadcast reception within the immediate area affected by the eclipse at any given time, it would be interesting to know precisely what steps were taken to measure the results.

Whatever may have been the results in such cases, the writer cannot help feeling that any expectations of improved transmission between America and England could have been based only on some oversight of the actual conditions relating to the eclipse.

Had this astronomical event caused simultaneous darkening of the whole tract of ocean and land, say between New York and London—an impossible thing, of course—there would have been excellent reasons for expecting striking results and some addition to our knowledge. As a matter of fact, however, the shadow cast by the moon on our earth at any moment on the recent occasion only covered a circular patch something like 100 miles in diameter, or, roughly speaking, about one-thirtieth part of the distance between New York and London (roughly 3,000 miles).

Although the umbra is a comparatively small shadow, it must be admitted, of course, that the penumbra is very large, spreading out to a diameter of some 4,000 miles, from which it would appear that when the eclipse was at its full, as seen from somewhere in mid-ocean, the penumbra would include London and New York at the same time. It has to be remembered, however, that the limits of the penumbra, though perfectly definite geometrically, are not so optically, and that it is only near the umbra that it is very dark, the penumbra fading away rapidly toward the outer boundaries. It has to be remembered also that an observer situated within the penumbra only sees a partial eclipse,

which is smaller, as his position is more distant from the cone of the shadows; thus, near the outer edge of the penumbra the moon will only slightly encroach on the sun's disk.

For these reasons I think we may regard it as unlikely that the penumbra would have any very important effect at any very great distance from the umbra.

Referring to the gnomonic chart, which appeared as fig. 3 on page 214, it would appear that the path of the eclipse at 15.0 hr.—the time when the greatest intensity of signals was noticed—lay quite 500 miles south of the nearest great circle shown on the chart, so that one edge of a circle with a 500-mile radius from the centre of the eclipse would only just reach the nearest great circle, *viz.*, that to Chedzoy, and would fall short by at least 100 miles of the one to Aberdeen. Seeing that the umbra was only about 100 miles in diameter, 1,000 miles diameter would seem to be a fairly liberal allowance for effective penumbra when it is remembered how little the sunlight appears to fall off until the moon has covered a very large proportion of the sun's disk.

A point of interest arises from the curves shown in figs. 1 and 2, from which it is seen that the highest signal intensity occurred at about 15.0 hr. when the eclipse had only just commenced here, and that the intensity was lowest at about the time of greatest phase —the reverse of what might have been expected. It is not clear why the curve relating to January 25th, shown in fig. 1, is so flat, whilst all the other curves so rapidly fluctuate. It is perhaps unfortunate that curve A in fig. 2 stops at 15 hr. where, though low, it showed a slight tendency to rise. Curve C shows a considerable rise over A from about 14 hr. 40 min., from which it would appear that the variations are considerable on days of no eclipse. No doubt such differences are due to variations in the atmosphere arising from extent of sunshine or cloud, &c. Whilst it is undoubtedly interesting to observe the steep peaks shown in the curves round about the time of the eclipse, it would be interesting to know more about the conditions of the sky generally over the Atlantic at the time. In the neighbourhood of London, as will be remembered, a bright morning was succeeded by a cloudy afternoon, which greatly spoiled views of the eclipse.

Another point may perhaps be mentioned. The time of total eclipse in New York has been given as 9.11 a.m., and the time of greatest phase in London as 3.58 p.m. Allowing for the difference in local time between the two places, *viz.*, five hours, we notice that the total eclipse in New York must have taken place at the instant which we call 2.11 p.m. Greenwich time, *i.e.*, nearly two hours earlier than the time of greatest phase here—a simple way of reminding ourselves how widely different were the conditions at the two places, one experiencing the fullest effects of the eclipse, whilst the other was entirely free. It may be argued, as the eclipse took rather more than two hours to run through all its phases at any place, that the last phase in New York would approximate in physical time to the time of the first phase in London, but at that time, about 3 p.m., when the signal intensity curves are shown highest, the sun's surface would be almost, if not entirely, exposed at both places, and the centre of the eclipse was 500 miles or more south of the great circles.

In a few words it is, I think, extremely doubtful whether the eclipse alone could have really affected transatlantic transmission. As to the reports which have been made as to American broadcasting stations being heard in this country at that time, it has to be remembered that more or less similar reports of unusual reception during daylight have been made from time to time when there has been no eclipse.

The following extract from the *Daily Telegraph*, dated January 26th, is certainly interesting:—

"We heard KDKA (Pittsburg) quite distinctly on 63 metres *when the sun was shining*—a very unusual phenomenon," said an official of the British Broadcasting Co. "We also heard WGY on 380 metres and WIT on 509 metres, both being American stations." The italics are mine.

A Lamp Signalling Installation.

The lamp signalling installation at the Queen's Hotel, Birmingham (L.M. & S. Rly.), briefly referred to in the columns of this journal of February 13th, is a great advance upon the old system of electric bell signalling which often, if not always, conveys its signals to everyone unconcerned.

By the mere pressure of the room push button at the "Queen's," lamps are lit over the door, outside the room, in the main corridor, in the attendant's servery, and in the reception or the manager's office. The attendant has to proceed to the very door of the room from which the signal has been given to extinguish the lamps, and he is obliged to give prompt attention, as while any one of these lamps is alight, the management is aware that a guest is being neglected.

Fig. 1.—Reception Office and Main Indicator Board.

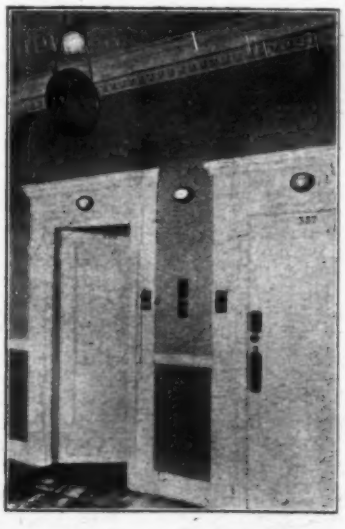


Fig. 2.—Room and Group Lamps, Release Push, &c.

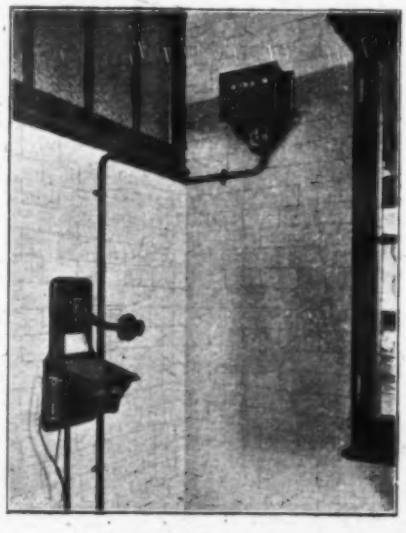


Fig. 3.—Corner of Service Room.

A morning call signal is also provided by which a maid can, by inserting a special linking device, operate a low-toned buzzer in any visitor's room, and the tone of the buzzer can be increased or decreased in volume to suit heavy or light sleepers.

The "maid finder" by which a signal can be given to the maid, no matter in which room she may be engaged at the time, from any one room on any particular floor is another unique part of this modern system.

Above all, the system ensures courtesy to a newly arrived guest. Upon a room being allotted to a visitor by the reception official, a signal is given in a similar manner to the attendant of the floor upon which the room concerned is situated, and in response to this signal the floor attendant is obliged to proceed to the lift entrance on that particular floor to extinguish the lamp by which the signal is received, and the visitor, on reaching the floor in question, finds the attendant waiting to conduct him to his room.

Fig. 1 illustrates a visitor registering on his arrival. On the right is the reception main control indicator board, by which may be observed prompt or delayed attention to visitors' requirements. Over the word "Office" will be seen an oval type lamp which is illuminated immediately a visitor has duly registered, by the reception official pressing a button, and the head porter on observing this is compelled to proceed to the reception office to extinguish it by the pressure of a special push button. Upon ascertaining the room allocated to the visitor, he calls the floor attendant to the lift entrance on the floor concerned as described above, and the head porter knows, by the extinction of the floor lamp, that the attendant is ready waiting for the visitor, who is then sent up on the lift.

In fig. 2 will be seen two room doors opposite the lift entrance on the third floor, and over the doors are the coloured room lamps, while the corridor group lamp is shown over the centre of the clock. To the right of Room 335 is the release push, the morning call link device, and maid finder push. The lamp shown on the wall between the two rooms is the one by which the head porter signals to the floor attendant to stand by the lift entrance to receive the visitor being sent up, and it is extinguished by the push mounted underneath.

Call lamps and attendants' pushes are also arranged in the drawing rooms, smoking rooms, and bath rooms.

Fig. 3 shows a corner of the service room with the group indicator board.

The whole installation has been designed, manufactured, and installed by the International Electric Co., Ltd., to whom great credit is due.

Electricity in Mines.

By Major E. IVOR DAVID, M.I.E.E.

(Abstract of paper read before the Institution of Electrical Engineers.)

(Concluded from page 356.)

The steam winder has proved itself trustworthy, but the electric winder is more efficient, easier to control, and easier to maintain in a state of efficiency; both are equally reliable when of high class and of suitable proportions for their loads. The case can therefore be settled on running cost so far as the winder is concerned, but the remainder of the plant must influence the choice. If the mine is deep the winder may take anything up to 50 per cent. of the total power consumption of the mine, and the load on the generating plant is extremely variable and the average load small compared with the peak load. For single deep mines, therefore, electric winding may not be justified, but if the mines can be grouped and either interlinked or power generated at one or more central power stations, the superior economy of the electric winder can be utilised to the fullest advantage.

For shallow mines, particularly where heavy loads can be wound at low speeds, the electric winder is usually two to three times as efficient as the steam winder. Capital charges are slightly higher for electric winders and high-pressure generating plant than for steam winders and mixed-pressure plant, but the total of running and capital charges is in favour of the electric winder. If power is available at reasonable rates from a reliable supply company, then capital charges will be greatly in favour of electric winding, and the running cost should still be lower than for steam winders.

The a.c. motor being inherently a high-speed machine, gearing has been necessary in most cases, in some instances self-contained with its own bearings, but the two largest a.c. winders in this country at the present time have the spur wheel mounted directly on the drum shaft (which is carried in three bearings) and the pinion coupled to the motor by a flexible coupling of the Bibby type. It is impossible, with an a.c. motor and rheostatic control in the rotor circuit, to obtain the same delicacy of control as with the Ward-Leonard system.

In high-speed winding, necessary owing to the reduced working hours in mines, retardations of 4.5 and in some cases 6 ft./sec./sec. are necessary to obtain the required output. Normal brake blocks last only a few weeks, and reverse-current braking is cheaper and more reliable and is used for ordinary coal winding and for lowering men. Regenerative braking is permissible for lowering men for long, slow winds, but reversed current is used to slow down at the ends of the winds. Actually it is safer to use regenerative braking under the above conditions, as it provides a definite limiting speed (5 to 10 per cent. above synchronism), rather than to switch off and brake only when the speed becomes excessive.

The frequency of operation of winder control gear necessitates the switches being very robust. In electrically operated air-break contactors, the force necessary to obtain rapid movement is large, and there is a tendency to bounce; also, vibration loosens fastenings and fractures small interlocks and mechanism. To overcome this trouble, compressed air has been tried as an operating medium (fig. 5) with very satisfactory results. An interesting feature of large air-break contactors is that the arc produced when a current of low power factor is broken is much greater than that from a current of high power factor. Apparently the blow-out coils are less effective when current and voltage are considerably out of phase, as in the case of the no-load current of a low-speed a.c. motor.

With all their limitations, however, there is a great field for a.c. winders, from small winders at shallow depths to large winders raising heavy loads at low speeds from greater depths. For maximum efficiency the a.c. winding diagram should be so arranged that no braking is necessary. This means that power must be cut off at such a point that the

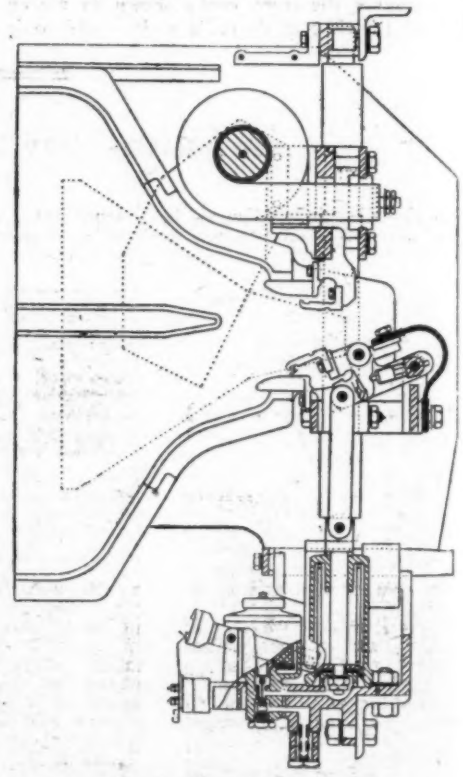


Fig. 5.—Air-operated Contactor.

inertia of the moving masses is just sufficient to bring the load to bank with the merest touch of the brakes to hold the load as it drops on the keps. It requires considerable skill on the part of the enginemen to judge correctly for each differing load the exact point at which to cut off power. The general tendency is to cut off a little too early, so that power has to be switched on again to bring the load to bank. Fig. 6

is a typical wattmeter diagram of such a wind for a cylindrical drum. With a cylindro-conical drum the resulting load on the motor is often twice as great as when lifting the normal full cage from the bottom, as the full cage rope is on the large diameter, and the motor receives little help from the empty cage and rope which is on the small diameter. Cutting off too late results in heavy braking.

The advantages of the a.c. system are simplicity, low capital cost, less space occupied, no stand-by losses; and of the Ward-Leonard system, flexibility, ease of control, complete automatic control if desired, lower wear and tear of brake gear, peak loads on system gradually applied (not instantly as in the case of a.c.) and of shorter duration. For high-speed winds the Ward-Leonard system is usually more efficient; for heavy loads from deep shafts at moderate or low speeds, i.e., where the Stjernberg coefficient is low, a.c. is more efficient. Where it is a question of getting a maximum output from a certain size of shaft with definite limits of weight per wind, the Ward-Leonard system is usually necessary. The two-speed cascade motor shows a considerable increase in efficiency and reduction of peak loads over the single-speed induction motor owing to the reduced rheostatic losses. This type of motor has only been tried in moderate sizes, and further experience is necessary before mining engineers will be prepared to take advantage of the evident improvement possible in the larger sizes. Several large d.c. equipments have recently been installed with geared motors, but while a commercial case has evidently been made out for these, it can only be in first cost, and balance of efficiency is in favour of the direct-coupled motor. Reliability and maintenance costs are still more in its favour, as there is only one low-speed bearing to maintain, against two low-speed and four high-speed bearings, a pair of gears, and a flexible coupling. These

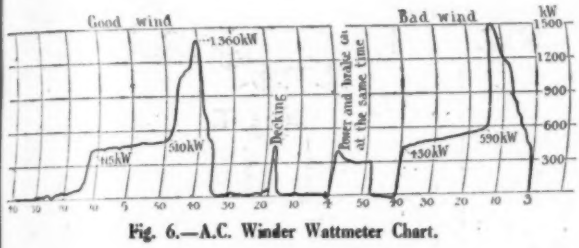


Fig. 6.—A.C. Winder Wattmeter Chart.

factors will justify a considerably higher first cost in the case of a direct-coupled motor.

The winding speed which gives maximum efficiency for any coal output can be fixed and maintained in a Ward-Leonard equipment, the speed being increased from time to time as the mine develops and the output increases. Complete equalisation for winding schedules raising large tonnage from considerable depths is not feasible, and even partial equalisation involves heavy flywheels and correspondingly heavy light-load losses. The author is of the opinion that money can be more suitably spent in increasing the generating plant capacity and in improving the transmission system generally. If a flywheel with speed variation is not to be used, then the efficiency and reliability of the equipment may be improved by driving the motor-generator set by a synchronous motor, the efficiency of which will be at least 2 per cent. higher than that of an induction motor for similar output. The comparative efficiencies of two equipments of almost equal size are given in Table III.

Table III.

		Light-load losses. kW.	Average efficiency. Per cent.	Peak load. kVA.	Overall efficiency. Per cent.
Ward-Leonard generator and synchronous motor		80	92.0	3,480	61.0
Ilgner	(10,500 V) ...	205	83.0	3,300	47.0
	(3,200 V) ...	150	—	—	—
	(3,200 V) ...	115*	—	—	—

* Without flywheel.

The idea that Ward-Leonard sets must of necessity cost more for maintenance is incorrect. Average yearly maintenance costs would be as follows:—

An 1,100-h.p. a.c. winder with oil-immersed switches £250
An 1,100-h.p. a.c. winder with air-break contactors... £150
A similar Ward-Leonard set £105

A.c. winders will effectively carry out all the operations they may be called upon to do, but from 50 per cent. of their schedule load upwards the Ward-Leonard winder is more efficient in straightforward weight-raising, and for all weight-lowering and low-speed word Ward-Leonard operation is considerably more efficient; in addition, the control is safer, smoother, and simpler and lends itself to complete automatic operation. An approximation based upon a number of recent installations is that the complete Ward-Leonard set, including drum, &c., costs 30 per cent. more than an a.c. set for an output of 250 tons per hour from a depth of 600 yards.

An alternative to the usual steam winder and mixed-pressure turbine for isolated collieries has recently been installed for an output of 3,000 tons per day from a depth of 1,000 yards. A Ward-Leonard motor-generator set is driven through gearing by a high-speed turbine. This supplies the two winding motors, controlled by varying the voltage of the Ward-Leonard generators, the turbine governor permitting a large range of speed, so that a moderate size flywheel can supply a considerable amount of energy. Full advantage can be taken of the flywheel energy, as speed reduction is not accompanied by a corresponding reduction in efficiency; further similar equipments are in progress.

There are very few cases where a mixed-pressure steam-winder plant can compare favourably with an all-electric plant. Steam-winder manufacturers usually give consumptions per shaft horse-power or per hour for a given schedule, and ignore stand-by losses, but figures given in the paper show that stand-by losses are considerable and, in addition to smaller boiler plant being less efficient under the varying load, a better class of fuel has to be used than in the large stations. In conclusion, examples are given in Part III of the paper of actual results of the progressive conversion of several mines from steam to electrical operation and the effect of supplying compressed-air power from a central station in a similar way to electricity is indicated.

These results show that wherever accurate records are available, electrification of the whole of the machinery at a colliery can be proved to be a sound commercial proposition. The reduction in pit-head costs resulting from a highly efficient plant is appreciable, although the total cost of power is small compared with the labour costs at a colliery, and the usual method of costing makes it difficult to prove the reductions. The principal effect of electrification is to reduce the amount of unskilled labour employed at the pit head, this unsatisfactory and difficult-to-manage gang being replaced by a few skilled hands. Electrical plant has one special advantage in that the actual consumption of every machine, or group of machines, can be continuously recorded and any waste checked. Further, electrical plant retains its high efficiency without the constant adjustments and renewals necessary in other machines.

A Thermionic Valve Testing Set.

120,000-volt d.c. Cable Testing.

By J. URMSTON.

(Abstract of paper read before the London Branch *of the* Association of Mining Electrical Engineers.)

If a valve M and a condenser K be connected through a transformer T in an a.c. circuit, as shown in fig. 1, p. 394 (B being the filament battery), the valve will be conductive when the transformer winding connected to the filament F is negative, so that the coating of the condenser connected to the plate P will become negatively charged, or if the condenser is between the filament and the transformer, positively charged with reference to the other coating. The fact that the condenser can be so charged with reference to sign renders possible the use of the Delon system of connection. If the condenser has little or no leakage, the potential to which it will be charged will be practically equal to the peak value of the A.C. voltage applied. If V = voltage of transformer and V_1 = the voltage of the condenser when charged, then $V_1 = \sqrt{2}\,V$.

The simplest testing set is shown in fig. 2; the testing transformer T is of 3 kVA with a ratio of 200/60,000 volts, and the secondary winding withstands 120,000 V d.c. to earth; R_1 and R_2 are variable resistances, and R_3 and R_4 fixed resistances of half a megohm each; the 250-watt Kenotron M can pass 100 milliamperes, withstand 80,000 volts a.c. between cold electrodes without signs of distress, and requires 10 amperes at 12 volts to heat the filament to the correct temperature; P is the valve plate, and F its filament heated (instead of by a battery B as in fig. 1) by a transformer T_2 with a ratio of 200/14 volts, the secondary winding which supplies the filament current withstanding 80,000 volts a.c. all round; for measuring the filament current, A_2 reads up to 12 amperes, and the d.c. meter A_1 reads up to 100 milliamperes; V is an electrostatic voltmeter reading up to 120,000 V, while C_1 is the conductor of the cable being tested (in place of the condenser K in fig. 1).

To operate the set, R_2 is adjusted until 10 amperes pass through the filament; T is then switched on and R_1 adjusted

slowly until v registers the voltage required. It is as well to provide a low-reading voltmeter across the primary of T; the ratio of transformation being known, the secondary voltage can then be calculated. Generally if the leakage is very small,

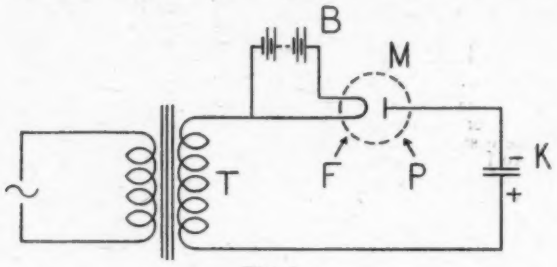


Fig. 1.

say, not more than 0.2 milliampere, the d.c. voltage on the cable will be the peak value of the voltage of the testing transformer secondary. The ratio of the d.c. voltage read to the a.c. voltage applied to the valve will nearly always be approximately 1.4 to 1. It is always advisable to check the ratio before the full d.c. voltage is reached.

It is essential to place one fixed resistance between the transformer and the valve, large enough to dissipate the full voltage of the transformer for the maximum current which the valve can pass, thus making it impossible to burn out the valve.

The set is suitable for d.c. tests up to 60,000 volts to earth, and is capable of charging many miles of cable to that voltage. When higher voltages are required, the Delon system can be used by substituting two valves for the mechanical rectifier, and both halves of the wave are used. The two valves are connected to one end of the h.p. winding of the transformer in the manner shown in fig. 3. When the set is in operation, the following relations will exist: Voltage of core 1 with respect to core $2 = -\sqrt{2}$ v, voltage of core 3 with respect to core $2 = +\sqrt{2}$ v, where v is the h.p. a.c. applied. Therefore, the voltage between core 1 and core 3 will be $2\sqrt{2}$ v. Either core 3 or core 1 can be earthed without altering the above relations, and in this manner, a voltage of $2\sqrt{2}$ v can be applied between cores and between cores and earth. With these connections, voltages up to 120,000 volts to earth can be obtained.

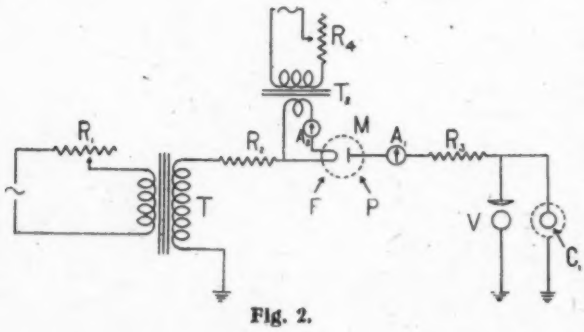


Fig. 2.

If there is a heavy leak, and consequently a large reading on the milliammeter after the d.c. voltage has settled down to a steady reading as indicated by the voltmeter, the ratio of 1.4 to 1 mentioned above will not be obtained. If a voltmeter v reading peak values is placed across the h.p. winding of the transformer and another v_2 across the load, in addition to the ordinary voltmeter v_1, the three will register different values. For example, fig. 4 shows a leaky cable under test. The difference in the readings on v_1 and v_2 is due to the fact that v_1 registers an r.m.s. value while v_2 registers the peak value. Had the cable had little leakage, they would have registered equal readings; some of the charge on the cable leaks away, and so causes fluctuations in the voltage on the cable. The difference in reading between v and v_2 is accounted for by the fact that the voltage and current curves flattened when passing through the valve owing to the filament not being of sufficiently high temperature for the particular amount of current passing. It would seem, therefore, that when there is a large leakage current, the correct way to measure the voltage is by means of a voltmeter reading peak values. There is room for some considerable investigation in this direction.

If there is leakage, there will be alternate charging and discharging. The charge will leak away during the whole period, while charging will take place during a portion of one half cycle only. The charging current will be averaged by the ammeter, and the reading may be taken as the leakage current. If the leakage is small and the ratio 1.4 to 1 is almost obtained, no great error will be made in accepting the voltage on the cable, as registered by the ordinary voltmeter, divided by the current as shown on the milliammeter, as the insulation resistance of the cable at the time the readings are taken; the time of electrification should be stated. The loss of charge method would be more accurate, but would take longer. Other methods of calculating the insulation resistance are under consideration.

The discharging of the cable is effected by earthing the valve side of the high resistance, and it is advisable to leave the cable earthed for 24 hours after the test.

High-resistance faults can be broken down by this set, though in some instances it may be necessary to keep the set connected for half an hour or more, especially in the case of faults which seal up, or are due to a flash over in a joint from which the compound has run.

In the opinion of the author, the peak value of the a.c. pressure-test voltage is sufficient to enable defects, especially when water is present, to be detected. It is assumed that

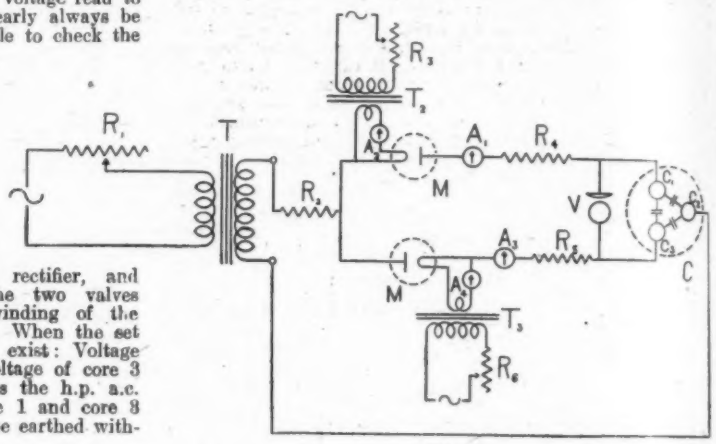


Fig. 3.

the peak value of the a.c. voltage is $\sqrt{2}$, the r.m.s. value. Much investigation has been, and is being, made on the question, but so far general agreement does not seem to have been reached.

With regard to the time for which the test should be applied, the author is of the opinion that fifteen minutes is quite long enough.

Discussion.

Mr. H. B. Gough confirmed the author's point as to the agreement of pressures using r.m.s. and peak meters and also calculations from the primary voltage across the main h.p. transformer. He mentioned that the Kenetron testing outfit could be used for overhead lines as well as cables; if a cable stood up for more than 10 minutes the test could be regarded as being perfectly satisfactory in every way. A voltmeter would probably be more useful than an ammeter for measuring the filament current.

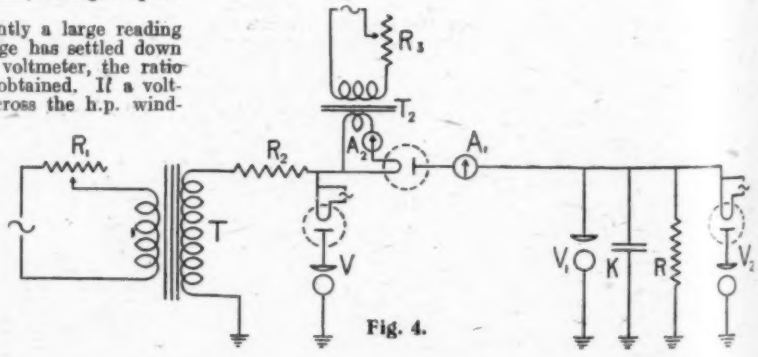


Fig. 4.

Mr. B. T. Gossling was glad to find one man, at least, who did realise all the points which arose. He had heard it said that by using the Delon arrangement they could use the valves for double the test voltage otherwise used, but in that arrangement the voltage across the valves fluctuated between a small value, depending on the leakage and the characteristic curve of the value, and the full double-peak voltage. From the point of view of the breakdown of the valves, nothing was gained by putting the two valves in series. He believed the Delon connec-

tion was very commonly used, because the lower voltage cables were almost always multi-core. He was extremely glad the author incorporated a high series resistance, with the object of protecting the valve. That made it possible to use almost any type of valve which would stand the reverse voltage. It was possible to design valves which would stand a dead short-circuit for the length of time required to blow a fuse or trip a circuit breaker because it took some seconds for the anode actually to become hot. It would be a sensible thing to include, among the various things entering into the rating of cable-testing valves, the heat capacity of the plate of the valve, which could be expressed conveniently in kW seconds. One kW second equalled 250 calories, a definite quantity of energy which could be put into the anode in a short time without harming the valve, and if plates were made of rather heavier-gauge metal one could easily get a rating of 7 or 10 kW seconds. If, in severe treatment, a blue glow were noticed in the valve, indicating that the vacuum had been impaired, it did not necessarily mean that the valve was hurt; after waiting a few minutes for the valve to cool down the vacuum would be as good as ever.

Mr. J. Schuil, referring to fig. 4, and the three voltmeters there shown, pointed out that the big variation in the readings might be explained by saying that the peak voltmeters, although agreeing between themselves, might under certain conditions be untruthful, but he believed that the main trouble lay in the combination of the series resistance of large value and the limited capacity of the valve not being able to deal with the current leaking across the special path provided; nearly all the charge leaked away before the valve could replenish it. He had also come to the conclusion that there was better agreement the larger the capacity charged, as, with an electrostatic voltmeter alone, he had never been able to get the $2\sqrt{2}$ reading on the voltmeter, and would prefer 1.25 as more nearly the average value of the rectified voltage. In the testing sets supplied by himself, the transformer was rather larger, so as to be useful for a.c. testing in power stations. There were valves on the market which could actually rectify 80,000 volts, so that with two in the Delon scheme one might get 160,000 volts, with 80,000 plus and 80,000 minus.

Mr. J. F. H. Colyer said that d.c. testing had come to stay, but he had found difficulty in obtaining valves of English manufacture.

Mr. J. R. Cowie said that when investigating insulation and switchgear, the practice on the Continent and in America was apparently to limit the duration to one minute, because putting excess pressures on certain forms of insulation did material damage to them, so much so that their life was shortened, and ultimately they would break down at a value much below the normal working value; it might be that in cable testing similar damage was being caused unwittingly.

Mr. J. Urmston, in replying to the discussion, said that the main point he wished to draw attention to was the measurement of voltage, and he had exaggerated a test in order to bring out the different readings obtained with the voltmeters; if they took ratios they should not jump to conclusions that the voltages were all wrong. The cost of valves ranged from £50 to £16. He had had some valves for three years, and they were still being used.

Mr. J. W. Gibson (hon. branch president), who presided, said there were many collieries where the system described could be used without risk. Only in the in-bye cables might there be a risk of ignition of gas through sparking over, but the cables laid in-bye into the areas where there was risk of gas were small in number, not more than about 5 per cent.

The British Industries Fair.

(Concluded from page 328.)

Messrs. Ricketts & Dauncy.

This firm had a large and varied collection of radio components and accessories on show. One notable device was a variometer in which, contrary to the common practice, the fixing of the dial is independent of the variometer spindle. The dial has a separate spindle, which is slipped into the variometer axis and secured by a set screw. In addition, the device is fitted with a simple means of changing over the windings from series to parallel or *vice versa*.

Messrs. Whittaker Bros., Ltd.

This firm, which manufactures domestic clothes wringers, showed one of its machines adapted for electrical operation. This is effected by simple chain drives between the rollers, and a belt drive from a small motor to the lower roller.

The Radi-Arc Electrical Co., Ltd.

In addition to the "Liberty" wander plug, which incorporates a high resistance rendering it possible to place the h.p. battery leads across the filament terminals without damage, this company exhibited "Liberty" and "Hogarth" crystal receiving sets, and constructors' valve sets. The principal feature of the former is the employment of a flat "D" type variometer, which occupies a very small space. The "ironclad" type is built into a circular stamped metal sheet case about 6 in. in diameter and 2 in. deep. This is finished in black enamel, and all terminals and external fittings are nickel plated. The "Hogarth" valve receivers are fitted with specially selective circuits.

Armack Patents Co.

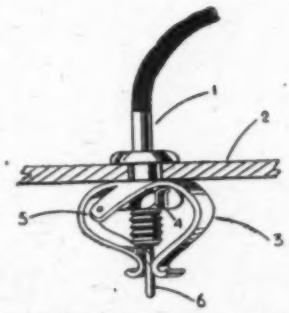
This firm also had a large display of radio equipment. One notable device was an earth tube of copper with spiral fluting, which enables it to be screwed into the ground. Moulded variometers of various sizes were shown, and a feature was made of devices with single-hole fixing. Among these was a crystal detector, fitted in an inclined bracket. The "cat's-whisker" lead is rubber-covered and passes through the centre of the crystal terminal. Another "single-hole" device was a small switch with a simple plug and spring contact. Some of the receiving sets shown had a swivelled blade on one of the coil plugs, the other plug being slotted to receive this when it is desired to short-circuit the plugs for the normal wave range of the set.

Moseley Electrical Co.

"Meca" radio accessories were displayed on this stand. The ebonite manufactures, such as coil plugs, holders, &c., were all of excellent finish. A pattern of variometer which was shown can be taken apart by the unfastening of a single screw, the rubbing contacts between the stator and rotor windings being quite as efficient as the common soldered wire connection and giving much less trouble. The coil holders shown had an internal spring washer locking device, which effectively secures the moving member in the desired position. Another simple but useful device which was to be seen on this stand was a combination terminal. The stem of this is slotted so that, in addition to its use as an ordinary wire-binding terminal, it will take and secure the tags of telephone leads. Various patterns of condenser, the "Newey," "snap-fastener" connector, and plaited-wire aerials were exhibited.

Mr. S. Wilding-Cole.

Upon this stand appeared examples of the productions of firms for which Mr. Cole is agent, *viz.*, Dubilier Condenser Co. (1921), Ltd., Brandes, Ltd., A. C. Cossor, Portable Utility Co., Ltd., Gambrell Bros., American Hard Rubber Co. (Britain), Ltd., S. A. Lamplugh, Ltd., and Oldham & Son, Ltd. The result was a large display of radio apparatus of all kinds. Among the devices on view may be mentioned the "Duwat-



1. Push-in terminal tag. 2. Ebonite panel. 3. Clamping jaws. 4. Locking nut. 5. Soldering tag. 6. Terminal end.

Fig. 3.—The "S.W.C." Terminal.

con" series-parallel condenser, with a very smooth change-over (Dubilier); "Cossor" valves, with the new non-capacity base in lieu of the former base; new patterns of radio-frequency transformers by Gambrell Bros., &c. Among Mr. Cole's own devices was that illustrated in fig. 3. This is a terminal on the lines of a telephone jack. Although it was primarily designed to take the tags of telephone flexibles, it can also be used for any purpose on a receiving set. To this end the plug terminal is provided with special tags which can be soldered to the ends of earth and aerial leads, &c.

Messrs. Thomas Broadbent & Sons, Ltd.

Hydro extractors and centrifugal machines were the principal exhibits of this company. These machines are used in a large number of industries for such purposes as separation, precipitation, dehydration, &c., and the field for them is constantly widening. The largest machine shown was a 36-in. "overdriven" swan-neck type centrifugal machine, driven by

a separate motor; there were also a 21-in. "overdriven" machine and a 26-in. "underdriven" machine. These were all belt-driven, and were provided with "Broadbent" centrifugal clutches (already described in our pages), which ensure easy starting against full load with a minimum starting current. A number of machines with the motors built into them were also on view. In these cases, too, the "Broadbent" clutch is employed to enable the motor to attain speed before commencing to drive the machine. This arrangement, it is claimed, gives complete protection to the motor and reduces the starting current. Smooth and efficient running is ensured by the use of ball and roller bearings.

Messrs. Peter Curtis, Ltd.

One of the principal parts of this company's display of radio apparatus was its "Duodyne" apparatus. In these receiving sets double h.f. amplification is employed. The first h.f. valve functions through a "Curtis" constant-tuned h.f. amplifier, which is followed by an "orthodox" tuned anode circuit immediately before the rectifying valve. It is claimed that the constant-tuned amplifier is absolutely automatic in action, requiring no control whatever. In the company's sets, which are built into ornate cabinets or simple boxes, as desired, the circuits are as described or are followed by one or two l.f. amplifying valves. Another range of sets exhibited by the company was the "Radionette" type. The range included crystal and crystal-valve receivers. The "Silver Ghost" crystal set in an aluminium case was another neat design shown by the company.

The Paragon Rubber Mfg. Co., Ltd.

This company, which is associated with the preceding one, had a comprehensive display of its hard-rubber products for electrical and other purposes. This included crystal and valve panels, telephone earpieces and handles, dials, variometer rotors and stators, coil holders, &c. Ebonite grained to simulate mahogany and walnut was also exhibited, the latter being very like the real article.

Cable Companies.

The Eastern Telegraph Co., the Commercial Cable Co., and the Western Union Telegraph Co., each had a stand to advertise its services. The apparatus exhibited included transmitters, receivers, printers and other message-handling machinery, as well as apparatus for laying and recovering cables.

The M.A.P. Company.

This firm displayed radio and ignition apparatus. Among the former was a combined single-valve amplifier and loud speaker, the horn of the loud speaker being fitted into one side of the containing box. Cabinet four-valve sets were also shown, as well as a number of loud speakers with composition and aluminium horns. Various types of sparking plugs appeared on the stand.

Messrs. Skett & Co.

A speciality of this firm was the "Sketophone" loud speaker, which is an instrument of handsome appearance with a nickelled base and a polished wooden horn. Other appliances shown were lightweight head telephones of British manufacture, and hand telephones (single) for ladies' use. The firm also showed coil-holders, compact l.f. transformers, &c.

British Electrical Repairs, Ltd.

As at previous Fairs, this company, which is associated with the British Engine, Boiler & Electrical Insurance Co., Ltd., exhibited examples of its rewinding work, showing armature and other coils in various stages of making-up.

City of Birmingham Electric Supply Department.

The Department had a stand on which both large and small electrical apparatus were exhibited, and, in some cases, demonstrated. There were examples of domestic appliances, kettles, irons, fires, a cooker, &c. The heavier apparatus included a welding plant, a hardening furnace, a magnetic separator, a small hoist and small tools.

Fig. 4.—The Birmingham Electric Supply Department's Stand.

The Department also equipped one of the demonstration steel houses, providing a water heater for the bathroom, a cooker and washing machine in the kitchen, electric fires, and a complete range of household appliances. A view of the stand appears in fig. 4.

Other Exhibitors.

Radio apparatus was also shown by Messrs. WINEBERG AND CO., and Messrs. H. E. ASHDOWN (BIRMINGHAM), LTD. The STEAM FITTINGS CO., LTD., showed a number of dial thermometers, steam traps, temperature regulators, and other steam-plant accessories, including gauges with electrical alarm contacts. Messrs. PERRY, BEVAN & CO., LTD., displayed art metal lanterns, floor standards, and other fittings, and Messrs. WAITE AND SON had a large collection of silk shades in a variety of shapes and colours.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Westminster" Commutator Grinder.

Fig. 1 illustrates a commutator-grinding machine which has been designed by the WESTMINSTER ENGINEERING CO., LTD., Victoria Road, Willesden Junction, N.W.10. It is claimed for this machine that it is extremely simple to operate, solidly constructed, and free from vibration. The machine is reversible for right- and left-handed work, and it is possible to grind right into the roots of the commutator lugs, the projection of the wheel being easily altered so that the grinder can be put as close to the commutator as convenient. There is a fine screw adjustment mounted between the guide plates for setting the emery wheel up to its work, and at the far end of the traveller bar there is a screw adjustment for belt tightening. The bedplate is of solid construction preventing vibration, and is fitted with a guide screw so as to give a maximum stroke of 25 in. It is provided with 12 holes for holding-down bolts. It is generally found convenient to bolt two channel irons across the face of the end pedestal to which one end of the bedplate can be attached. The other end of the bedplate can generally be supported from the frame of the machine, either from the field magnet yoke or packed up from the bedplate itself.

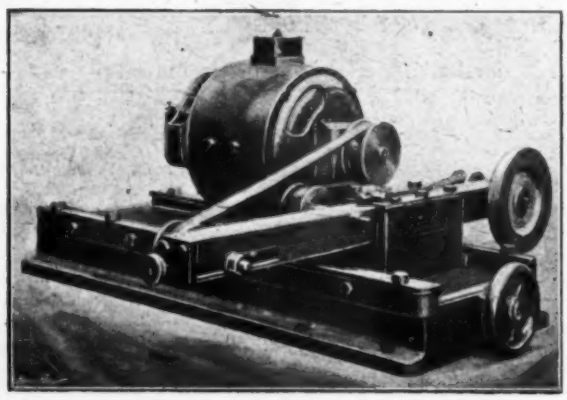


Fig. 1.—The Westminster Commutator Grinder

The set is provided with a 1-h.p. a.c. or d.c. belt-driven motor.

Wind Dynamos for Battery Charging.

We have previously mentioned the high-speed wind dynamos placed upon by the market by MESSRS. F. A. WILKINSON AND PARTNERS, LTD., Gretton, Northamptonshire. A new type of machine has now been evolved in order to meet the present demand for a small direct-current supply of electrical energy for charging low-voltage batteries for radio installations, motor-cars and other purposes. The apparatus comprises a high speed dynamo having a capacity of 30 W with a direct-coupled impeller. The machine is mounted upon a platform which is fitted with a swivel head and wind direction vane. A tubular support and automatic cut-out are also included in the outfit. The installation is automatic in its action, being started and stopped by the velocity of the wind at any time during the day or night, and it can be easily removed and re-erected in the event of a change of residence or for other reasons.

The "Omnipoise" Hospital Fitting.

The "Omnipoise" bracket, illustrated in fig. 2, has been designed by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2, especially for use in hospitals or other

institutions in which surgical operations are performed. On the lower arm of the bracket is fitted an adjustable main counterweight. This, in conjunction with a small counterweight which is free to move in either direction along the vertical arm, enables a perfect poise to be obtained in any

Fig. 2.—The "Omnipoise" Fitting.

position. Only the slightest touch is necessary to move the lamp from any position to another, and, in addition, a specially-designed ball joint enables the arm to revolve and extend, and to remain steady in the desired position. The standard finish is polished brass, but other finishes can be arranged for.

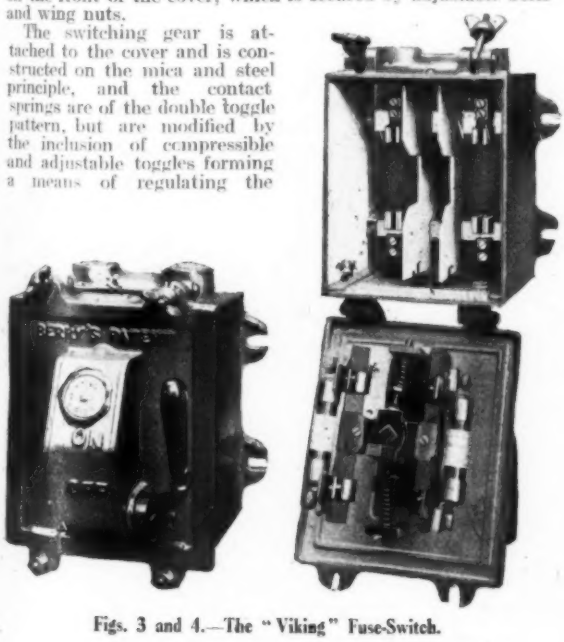
A Thermo-regulated Electric Boiler.

We have received particulars of the "Zent Electric Thermo-Storage Boiler" from M. L. Haussauer, 30, Ely Place, London, E.C.1. This is an ordinary domestic boiler fitted with a thermo-regulator of the mercury type to control the heating element. The current is switched off when the water reaches a given temperature, and on again when it falls a few degrees below this, thus maintaining approximately constant temperature. The regulator works on the bi-metallic expansion principle with a form of mercury make and break. The mercury is contained in a gasfilled vessel, and the makers claim complete absence of sparking. They also claim that very fine adjustments of temperature can be made, and that the consumption of electricity for a boiler of eight gallons capacity with a temperature up to 194 deg. F. is .45 kW.

The "Viking" Fuse-Switch.

We have received particulars of a new design of fuse-switch which is being put on the market by MESSRS. BERRY'S ELECTRIC, LTD., of 85/86, Newman Street, Oxford Street, London, W.1. The makers claim that the construction of the switch is such as to ensure easy and positive action, whether it is operated from a normal or high level, and all the current-carrying parts are of high conductivity copper liberally rated as to current density and surface contact. The switch case is of a robust character and is provided with detachable tube inlet bosses. The method of operation is by a lever type handle on the front of the cover, which is secured by adjustable bolts and wing nuts.

The switching gear is attached to the cover and is constructed on the mica and steel principle, and the contact springs are of the double toggle pattern, but are modified by the inclusion of compressible and adjustable toggles forming a means of regulating the



Figs. 3 and 4.—The "Viking" Fuse-Switch.

speed of the make-and-break action. The base contacts are mounted on triangular steel supports insulated with mica, which ensure rigidity of the base contacts and terminals. No porcelain whatever is included in the construction of this switch. Figs. 3 and 4 show views of the switch with the cover closed and open.

Correspondence.

***Correspondents should forward their communications* at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

The Lighting of Llandaff Cathedral.

We have read with interest the account under the above title in your issue of February 20th, and while in many details it is correct, the last paragraph is incorrect and misleading. As the contractors who carried out this installation, we ask in fairness to ourselves and others concerned that you will please publish this letter. We secured this installation entirely on the merits of our scheme and specification, the consulting engineers, Messrs. Wm. Angus Scott and Partners, Cardiff, recommending and advising the Dean and Chapter to accept our tender.

The statement made in the article, that the whole of the material was supplied by the Siemens & English Electric Lamp Co., Ltd., is not correct. The materials we purchased from this company were the Holophane glassware and the gasfilled and standard metal-filament lamps only.

The Chapter House is not as mentioned in the account, lit in a similar manner to the Lady Chapel, but by specially designed wall brackets.

The article as a whole, to our minds, considering the history attached to the cathedral, is compiled very badly, and we as the contractors and brains responsible for the scheme, together with the consulting engineers, are merely a secondary consideration.

It may be of interest to many of your readers if we add a few details of the history of this cathedral. Tradition says that King Lucius built a church at Llandaff about the year 170, the See of Llandaff, apart from that of Sodor and Man, being the oldest in the British Isles. Of the earliest church there are no remains. In the year 314 the first bishop was Adelfius of Caerleon-on-Usk, near Llandaff, and in the year 512 a market and mint existed at Llandaff. In 1120 the cathedral was begun by Bishop Urban, and in 1193-1229, the nave was extended to the present west front; in 1244-1265 the chapter house, of unusual form, square with a central pillar, was added; in 1265-1287 the Lady Chapel was built; in 1315-1360 the presbytery was remodelled; in 1375 the walls of the aisles of the choir and nave were rebuilt; and in 1485 the north-west tower was built. In 1575 the cathedral was reported to be an absolute ruin, while the Parliamentarians marching in helped on the work of destruction. Little was done until 1732, when a sort of Italian temple was built in the body of the cathedral, and from this time onward not only was the building allowed to perish, but the spiritual life of the church died with it. In 1835 restorations were begun and continued until 1857, when the east end of the cathedral was re-opened, and repairs were commenced on the nave.

It is noticeable that nearly all the cathedrals in England and Wales have been entrusted to the eminent architect, Sir Gilbert Scott, for restorations; Llandaff is one of the exceptions, the architect being Mr. Pritchard, whose excellent designs of woodwork (principally teak) were carried out by Llandaff workmen.

Owing to our knowledge of the above history, we prepared a scheme fully in keeping with the architecture and character of the building, and our wiring is so carried out in the chancel and nave that it is fully concealed, and the only indications to the naked eye of the most modern method of illumination are the actual Holophane units and gasfilled lamps.

p.p. **Haddrill, Hutchison & Co., Ltd.**
L. F. HADDRILL, *Director.*

Cardiff, *February 25th*, 1925.

[The statement that "all the material was supplied by the Siemens & English Electric Lamp Co., Ltd.," was made to us by that company in the notes provided for the purpose of the article. They wish to apologise to the other firms interested in the matter for the error. In order to make the position perfectly clear, we may state that we understand that they provided only the lamps and the Holophane glassware; that the Stella Conduit Co., Ltd., supplied all the conduit and conduit fittings; that the whole of the C.T.S. cable used was manufactured by the Liverpool Electric Cable Co., Ltd.; that the work was carried out by Messrs. Haddrill-Hutchison and Co., Ltd. (whose letter appears above); and that Messrs. Angus Scott & Partners acted as consulting engineers.—EDS. ELEC. REV.]

The Depreciation of the Electric Strength of Oil during Storage.

Being much interested in the purification of insulating oils, I have searched for the "report recently published" which showed that the dielectric strength of centrifugally purified oil fell during 48 hours from 50 kV to 38 kV.

The statement referred to above was made in an advertisement which appeared in your issue for February 6th, and I find that the writer is apparently referring to an article published in the ELECTRICAL REVIEW for December 5th, where results of a very extensive series of tests with a De Laval centrifugal oil purifier are recorded.

If this is so, I think it only fair in the public interest to point out that Mr. H. D. Jukes, the writer of the most valu-

able article referred to above, records that the initial dielectric strength of the oil in the tank was 45 kV, so that the depreciation due to 48 hours' storage in an ordinary tank, subject to the atmospheric conditions of an unheated works during wet weather, was 7 kV, *i.e.*, 15 per cent. instead of 24 per cent., as is suggested by the advertisement referred to above.

B. May.

Bushey Heath, *February 24th*, 1925.

German Terms.

What Mr. D. V. Onslow says on p. 291 of the ELECTRICAL REVIEW under the above heading about the meaning of the word "technisch" is not quite acceptable. Mr. Onslow is especially mistaken if he supposes that no technical fair, ["technische Messe"] takes place in Leipzig. On the contrary, Technics ["die Technik"] is represented at the Leipzig Fair in very large measure, and as regards electrotechnics, this for some years has occupied there a very large separate House, in which not only the leading electrical companies, such as the A.E.G. and Siemens, but also the moderate sized and small concerns prepare large exhibits of their novelties. Other branches also of "die Technik" are represented in large buildings, and it can indeed be said that the various branches of "die Technik" constitute a very important and substantial part of the Leipzig Fair.

It is also incorrect to say that the German word "technisch" is synonymous with "industriell." When the German Chancellor observed in his speech on the Dawes Scheme that some clauses had no technical import ("technische Bedeutung"), he did not intend to convey the impression that those clauses had no significance for industry; he rather meant that they were unimportant for the *execution* of the Scheme and probably used for it the phrase: "Für die Technik des Vertrages." In this transferred sense the words "Technik" and "technisch" are very much used in German. One speaks, for example, of the "Technik" of a pianist, a singer, or an actor, also of the "Technik" of a literary work, and means thereby the composition and execution of the same.

I think it is desirable to draw attention to the matter, in order to avoid misunderstandings in translation from the German.

Dr. M. Grunwald.

Berlin, *February 24th*, 1925.

[Posters on the London hoardings are now advertising the Leipzig "Technical Fair."—EDS. ELEC. REV.]

The Cost of Laying Mains.

I should be very much obliged if any of your readers could give some indication of the best and most accurate method of collecting costs of laying street mains and feeders in large towns. Is there any book published on this branch of accountancy, giving, say, costs of excavating, laying ducts and pipes, timbering trenches, filling up trench for permanent reinstating, concreting beds for ducts, &c., and how the total analysed costs are obtained per yard run, &c.? A lot depends, of course, on the width and depth of trenches as well as the nature of the road surface.

Sidney Geo. Budd.

Westcliff-on-Sea, *February 24th*, 1925.

Wiring Regulations.

I have read with interest the article under the above heading by Mr. F. W. Purse, and certainly agree with him that the regulations are very necessary. The only trouble I have with the present edition is that in several instances is one asked to do certain things, but there is no clear definition of what is required.

Take, for instance, clause 106 B-Portable Fittings. Such fittings should be made of treated hard wood or of some suitable non-ignitable composition. This paragraph refers particularly to portable handlamps, but although I have endeavoured, from several sources, to obtain the definition of "treated hard wood" I have not yet been successful; perhaps Mr. Purse would be good enough to let us have his definition of what treated hard wood really is.

There is also another point which I think the majority of contractors are likely to overlook, and that is, when using c.t.s., Maconite, or similar types of wiring systems, in basements and cellars, particularly where the lampholder is within reach, they will have to run a third earth wire in order to earth the metal lampholder. I believe that certain corporations are insisting on an insulated type of lampholder being used in all basements, but I am wondering whether this is the correct interpretation of the new I.E.E. rules.

J. C. W.

Manchester, *February 28th*, 1925.

Lead-covered Wiring and Visible Bonding.

With reference to the correspondence which has followed "Electron's" demand on February 6th for visible bonding of metal-sheathed cables used for surface-wiring installations, it is not quite clear why this visibility is required.

The essentials would appear to be, first, a bonding device which is really effective and easily applied; secondly, adequate supervision to ensure that the facilities provided are used when the installation is made.

One of the chief advantages of good surface wiring is that it is very inconspicious when properly installed, and the average consumer will not appreciate conspicuous mechanical devices being used merely on the ground that the latter, or the contractor's workmanship, cannot be relied upon.

Given the two essentials mentioned above, with a check test of the continuity of the sheathing on completion, it would seem that the bonding need not be looked at again.

In the surface-wiring system in which I am interested, the bonding device is extremely simple and very substantial, while the mere mechanical fixing of the cables practically ensures that an effective bond is made, and without the use of loose screws.

The reliability of this bonding allows the installation to be carried out very unobtrusively, and if the public will employ those contractors who will carefully compare the various bonding methods available and see that the system chosen is properly installed, there will be no need for greater visibility of the devices used.

H. J. Groves Webb, A.M.I.E.E.

London, *February 28th*, 1925.

International Electrical Relations.

From the point of view of the Free Trade doctrinaire it is desirable that each nation should make or do those things for which it is most suited by virtue of natural resources, climatic conditions, geographical position, and the character and genius of its population. Universal Free Trade would undoubtedly result in an adjustment of international commerce and industry on these lines.

Again, from the purely Free Trade point of view, such a re-arrangement would not only result in increased efficiency and probably cheaper costs, but the country which bought its requirements at a lower price from another would get an equivalent amount of wealth in return in some form or other. This contention is, no doubt, true in the abstract. There would, however, be certain concomitants which would go with such a re-arrangement. The most important one is the upheaval and dislocation which would occur in the industrial population, and it is conceivable that, whilst we might have the means to maintain a vast army of unemployed, we might, nevertheless, find that they would have to be permanently maintained until their numbers were brought down by death or emigration. Taking an extreme view, one could visualise the practical disappearance of many of our industries and the maintenance of the country left dependent upon a vast increase in banking, insurance, and shipping, which do not require anything like the *personnel* needed for the production of commodities.

History furnishes two outstanding examples of this character. In their time, the Phœnicians were the merchant princes of the world; later on Venice was a shining example of the power which can be achieved by non-industrial pursuits.

Power which is not founded on agricultural and industrial production, and consequently man-power, is unstable and unable effectively to face war and other disasters.

These considerations are matters of high policy and it may be thought that they have no direct connection with the electrical industry. The electrical industry, however, although still expanding, is by no means in its infancy. It is a sturdy youth and, apart from the indispensability of its product, the numbers employed in electrical and allied industries are formidable and the capital invested is quite a considerable element in the national structure.

The nation looks to the electrical industry for abundant supplies of electrical energy at a low price, and in endeavouring to answer the call it is not surprising that those responsible for the supply should endeavour to cut down all expenses excepting those which involve political considerations. This is no cynicism, but a matter of hard fact, as all important industries ultimately become influenced by political considerations of one sort or another.

In the purchase of plant and machinery, however, there is less restriction, and a considerable amount of plant is purchased from our Continental rivals on account of the economy which can be effected in first cost.

As long as this is kept within bounds it causes a certain amount of healthy competition, but if the practice should extend so as to form a considerable proportion of the country's requirements in generating plant it would be incumbent upon the Government to take steps to prevent the decay of a vital manufacturing industry. The same considerations might apply in the event of a super-super-power station being erected, say in Norway, which was capable of supplying electrical energy to British industries at half the present lowest British prices.

The industries would doubtless be anxious to take advantage of such a price inducement, and it is conceivable that the Government of the day might not take any action as long as the importation of electrical energy did not assume serious dimensions. It would, however, deserve the severest censure if it allowed it to become possible for the electric power supply of Britain to be cut off in time of war.

The principal advantage to be gained by free association with foreign electrical industry is in the direction of scientific discoveries and technical improvements. The interchange of ideas and the mutual use of patent rights has nothing to condemn it, and even financial combinations, if not too one-sided, are not necessarily against the public interest.

The main consideration from the national point of view is that none of our essential sources of supply of vital products should leave these shores.

A Manufacturer.

March 1st, 1925.

The Safeguarding of British Headphone Business.

I notice in the current issue of your journal a statement by Mr. Hooker, of C. A. Vandervell & Co., in connection with the proposed safeguarding of industries, and whilst I sympathise generally with Mr. Hooker's ideals, I think it only right to point out that the English manufacturers of headphones and other radio apparatus are much too hard in allowing terms off their manufactures. Take my firm, for instance; they are wholesalers, and have been for many years, but they cannot get terms from the N.A.R.M.A.T. manufacturers, with the result that they have to take the line of least resistance, and that is—buy foreign manufactures.

I think that the N.A.R.M.A.T. and other controlling firms of radio manufacturers should see a little more eye to eye with wholesalers in general, and then I feel sure the foreigner would not find such an easy market.

The Unwanted Wholesaler.

London, *February 28th*, 1925.

Parliamentary.

(By Our Special Parliamentary Reporter.)

County of London Electric Supply Co.'s Bill.—On February 25th this measure came up for second reading in the House of Commons, but was rejected by 183 votes to 80, chiefly on the ground that the company, although employing a good percentage of ex-Service men, was not on the King's Roll.

The rejection of the Bill was moved by Mr. BARNES, a Labour member, who said it was one of four Bills—two of which were before the House the previous week and the fourth was the North Metropolitan Electric Supply Bill—which aimed at forestalling a national scheme of electricity. The necessity for developing electric power was generally accepted, but it should not be considered from the standpoint of business exploitation. Electricity was essentially a service for public control, like the Post Office. In the hands of private companies it would be used to benefit the shareholders rather than the community at large. The Bill proposed to give the company special powers and privileges to exploit the supply of electricity in Essex and it was opposed for purely business reasons by the local authorities of Colchester, Chelmsford and Southend. He urged the House not to give a privileged position to an undertaking which had no connection with the localities to the detriment of the undertakings of the local authorities. Mr. GROVES, another Labour member, seconded the rejection.

Lt.-Col. MOORE-BRABAZON, Parliamentary Secretary to the Ministry of Transport, advised the House to give the Bill a second reading. He mentioned that in 1971 the Joint Electricity Authority which would then be set up for the County of London, would own the generating plant for power for the county of Essex. In this particular district the only generating authorities of any size were Colchester, Southend, and Chelmsford, and it was only in a congested area where there were many generating stations close to one another that it was thought desirable to set up a Joint Electricity Authority. The Commissioners had never envisaged the idea of a joint authority being set up for that area. The only time the company could come into the areas of Colchester, Southend, or Chelmsford, was if the authorities in those particular districts were unwilling or unable to give an adequate supply. In such a case the company could offer a supply, but there could be no question of undercutting, because the company must supply electricity at the same price throughout the whole county. The broad function of a local authority was the distribution of electricity. To let nothing but small generating plants spring up throughout the country would be most unwise. Replying to the point that the company was not on the King's Roll, he said it would be put on.

Sir L. WORTHINGTON-EVANS, the member for Colchester (Secretary of State for War), opposed the Bill, contending that it was an abuse of private enterprise. It did not put the company under any obligation to supply electricity anywhere, or to supply any local authority with any electricity at any time. Neither did it relieve existing local authorities of their obligation to generate and distribute electricity. After further debate the Bill was rejected, as stated above.

Private Bills.—The Horley District Gas Co. (Electricity Supply) Bill, the South Wales Electrical Power Distribution Company Bill, the Uckfield Gas and Electricity Bill, and the London & North-Eastern Railway (General Powers) Bill, have been read a second time in the Lords.

Electricity Supply by Gas Companies.—On February 24th Mr. Clarry introduced in the House of Commons a Bill to facilitate the supply of electricity by statutory gas companies. The measure was read a first time.

Electricity and Coal Demand.—On February 24th Mr. LOUGHER asked the Secretary for Mines whether he had any figures showing how much the demand for British coal had fallen off as a consequence of the utilisation by France and Italy of water power and electrical energy.

Colonel LANE FOX said he had not. It was quite impossible to make even an approximate estimate. As a matter of fact, the consumption of coal in France was greater by 6 per cent. in 1924 than in 1913, and in Italy it was down by only 2 per cent.

Telephone Exchange Sites.—On February 23rd Lord WOLMER, the Assistant Postmaster-General, informed Mr. Hannon that the number of sites for telephone exchange buildings approved since January 1st, 1924, was 83; the number of sites for such buildings for which negotiations were in progress was 80; the number of exchanges on which building work was in progress or would start before the end of the current financial year, excluding minor adaptations, was 117.

The Barbados Cable.—On February 23rd, in reply to Col. WOODCOCK, Mr. AMERY, the Colonial Secretary, said that the extension of the "All-Red" cable system from the West Caribbean to Barbados, &c., was now in working order. The cable from Barbados operated by the Pacific Cable Board linked up at Turks Island with the existing cables from that island to Jamaica and to Bermuda.

Answering a further question, Mr. AMERY said that the wireless stations at St. Kitts, Antigua, Dominica, St. Vincent, Grenada and Barbados, had been completed and handed over to the Pacific Cable Board for operation. The only station remaining under the general scheme was that at St. Lucia which it was expected would be handed over to the Pacific Cable Board that day. In addition to the stations provided for under the scheme a contract had been made by the Government of Montserrat for the erection of a station in that island.

Electrical Development.—On February 24th Mr. CLARRY asked the Minister of Transport when the investigation now being made by his department on the question of electrical development would be completed; and if he was prepared to consider representations from all sources relevant to the subject before arriving at any definite conclusions.

Colonel ASHLEY said the examination of this problem was a complicated matter and at present it was not possible to say when the investigation would be completed. He was always ready to receive and consider any representations which would help him in arriving at a solution.

Severn Barrage Scheme.—On February 24th, in reply to Col. WOODCOCK, Colonel ASHLEY said in accordance with the recommendations of the Water Power Resources Committee, the late Government decided that certain preliminary inquiries should be made with a view to ascertaining whether a tidal-power scheme in the Severn Estuary would be practicable and feasible from an economic standpoint. These inquiries, which were at present proceeding under the supervision of a Committee set up by the Department of Scientific and Industrial Research, had for their immediate object a decision on the question whether, having regard to local conditions, it would be possible actually to erect a barrage in the Severn. He understood that the actual expenditure to date had been £1,500, but further commitments had been entered into amounting to £1,050.

Electrical and Tramway Undertakings.—On February 24th, Colonel ASHLEY, in reply to Mr. RILEY, gave the following information with regard to electrical and tramway undertakings privately and publicly owned:—

Authorised Electricity Undertakings.

	Number.	Capital Expenditure.
Under public ownership	326	£103,500,000
Under private ownership ...	209	£54,800,000
Number of persons employed under public ownership ...	23,860	
,, under private ownership ...	12,500	
Tramway Undertakings.		
Under public ownership	170	£71,341,947
Under private ownership ...	73	£20,876,610

Chartered Associations.—A Bill has been introduced into Parliament for the protection of the names, uniforms, and badges of associations incorporated by Royal charter, the penalty for improper use of these on summary conviction being a fine not exceeding ten pounds.

Automatic Train Control.—On February 24th Sir J. PENNEFATHER asked what action, if any, had been taken in consequence of the report of the Committee of 1922 on automatic train control on railways; and the number of accidents due to lack of such control since that report was issued.

Colonel ASHLEY said that the special attention of the railway companies was called to this report, and they were asked to consider what action should be taken to give effect to the committee's recommendations. They had since, as recommended by the Committee, appointed a committee of experts to consider the whole question, and he was informed that the matter continued to receive close attention, but definite conclusions had not yet been reached. It was not possible to state the number of accidents due to the lack of automatic train control, but out of the 16 cases of collision in 1922 and 15 in 1923, into which inquiries were held, such control would, in the opinion of his officers, have prevented respectively seven and three.

Foreign Telephone Apparatus. — On February 24th Sir WM. MITCHELL-THOMSON informed Mr. Hannon that the value of foreign-manufactured telephone apparatus included in contracts placed by the Post Office with British firms during the year ended December 31st last was £11,855. The total value of contracts for manufactured articles placed with foreign manufacturers during the same period was £3,968, of which sum £1,880 was in respect of telephone apparatus.

Empire Wireless.—On February 24th Mr. Ammon asked the Postmaster-General whether he had considered the draft report of the committee appointed by the late Government on the organisation of Empire wireless; and what his decision on it had been.

Sir Wm. Mitchell-Thomson said he had read the evidence submitted to the committee and had decided on changes in organisation, including among others, the establishment of a separate branch under the charge of an assistant secretary, subject to the control of the Director of Telegraphs and Telephones, to administer the oversea telegraph services, including cables and radio. These changes had been carried into effect.

Wireless Receiving Licences.—On February 24th Sir Wm. Mitchell-Thomson informed Lt.-Commander Kenworthy that the number of wireless receiving licences at present in force was about 1,200,000. The Post Office had no material on which to form an estimate of the number of unlicensed sets in use.

Amateur Radio Stations.—On February 24th Sir Wm. Mitchell-Thomson informed Mr. Livingstone that no officers were employed solely on the inspection of amateur radio stations. The work formed part of the normal duties of officers of the Post Office Engineering Department, who were experienced in telegraph and telephone engineering and had the necessary knowledge of radio-telegraphy to enable them to ascertain whether an experimenter was complying with the conditions of his licence. The number of inspections of experimental stations made during the year 1924 was 584.

Amateur Transmitting Licences.—On February 24th Sir Wm. Mitchell-Thomson informed Mr. Crawford that on February 20th 2,181 "sending" wireless licences were in force and 126 applications were under consideration. From June 1st last to the end of last January, 265 applicants were granted licences and 126 refused.

Amateur Wireless Experimenters.—On February 24th, in answer to Captain Garro-Jones, Sir Wm. Mitchell-Thomson said that special facilities had been given during the winter months to a number of experimenters for the use of higher power than that authorised in their licences, in order that they might take part in organised experiments in transmission between this country and the United States and other countries. If there was a desire on the part of the organisers of the experiments to continue them during the summer months, he would consider any definite proposals which they might submit.

North Metropolitan E.P.S. Co.'s Bill.—This Bill came before the House of Commons for second reading on March 2nd. Mr. R. C. Morrison moved its rejection, stating that the Bill sought to "skim the cream off the surface" without satisfying the needs of ordinary consumers. Mr. Broad seconded.

Lt.-Col. Moore-Brabazon said that there was nothing in the Bill which would prevent a local authority becoming a supplier and distributor of electricity.

Sir H. Nield said that the Bill had the Electricity Commissioners' approval. It would be impossible for local authorities to produce electricity as cheaply as they could buy it in bulk from the company.

Mr. D. Herbert (C., Watford) said that his constituency had approved the Bill.

The second reading was carried by 221 votes to 91.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1923.

20,135. "Devices for exactly determining the direction of magnetic or electromagnetic fields of low, medium, or high frequency relatively to a direction in space." W. A. Loth and Soc. Industrielle des Procédés W. A. Loth. August 7th, 1923. (228,579.)

20,388. "Electric resistance welding." C. A. Hadley and Rose Street Foundry & Engineering Co., Ltd. August 10th, 1923. (228,583.)

24,703. "Quick-action air-break electric switches." M. F. Baur. October 4th, 1923. (228,591.)

24,860. "Incandescent cathode X-ray tubes." H. Wade (Naamlooze Vennootschap Philips Gloeilampenfabrieken). October 5th, 1923. (228,592.)

24,997. "Telephone exchange systems." Western Electric Co., Ltd. (A. Capek and F. Van den Broeck). October 8th, 1923. (228,593.)

27,320. "Electrical auxiliary control device for series or like direct current motors to control overspeed or overload, or both." G. Ness and E. H. Shinn. October 31st, 1923. (228,598.)

27,349. "Electrical counting apparatus." F. W. Francis and W. Cruickshank. October 31st, 1923. (228,600.)

27,494. "Method of and means for controlling electric circuits." E. B. Wilford. November 1st, 1923. (228,605.)

27,796. "Telegraphic transmitting apparatus." Creed & Co., Ltd., and F. G. Creed. November 5th, 1923. (228,610.)

27,800. "Shaft-setting arrangement, particularly for electric switches, and more particularly for electromechanical telephone systems." H. Baron (F. Aldendorff). November 5th, 1923. (228,831.)

27,818. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. March 19th, 1923. (213,218.)

27,819. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. April 9th, 1923. (214,195.)

27,849. "Indicating devices for electrical heating apparatus." W. T. Hughes and H. E. Angold. November 6th, 1923. (228,611.)

27,914. "Wireless receiving apparatus." F. R. Johnston. November 6th, 1923. (228,616.)

28,045. "Wireless receiving apparatus." Igranic Electric Co., Ltd., A. H. Mackley, and W. S. Flight. November 7th, 1923. (228,623.)

28,215. "High frequency amplifier transformers as applied to the art of wireless telegraphy." B. Hesketh. November 9th, 1923. (228,834.)

28,265. "Vacuum electric tube devices." E. Y. Robinson. November 9th, 1923. (228,638.)

28,374. "Systems of electric motor control." British Thomson-Houston Co., Ltd., H. C. Hastings, and E. B. Tuppen. November 10th, 1923. (228,643.)

28,499. "Electric relay apparatus employing thermionic valves." W. J. Brown, E. J. E. Hubbard, E. Y. Robinson, C. R. Burch, and Metropolitan-Vickers Electrical Co., Ltd. November 12th, 1923. (228,647.)

28,710. "Multiplex-carrier telegraph systems." Western Electric Co., Ltd. (Western Electric Co., Inc.). November 14th, 1923. (228,649.)

29,524. "Electric regulating systems." British Thomson-Houston Co., Ltd., and R. D. Parry. November 22nd, 1923. (228,656.)

29,550. "Electric switches." J. B. Tucker. November 23rd, 1923. (228,657.)

29,614. "Electromagnetic means for measuring the distance between two magnetic members or the period of vibration of one of them." British Thomson-Houston Co., Ltd. (General Electric Co.). November 23rd, 1923. (228,658.)

29,672. "Balancer for unsymmetrically loaded alternating-current systems." A. H. Railing and M. L. Kahn. November 24th, 1923. (228,659.)

29,742. "Automatic and semi-automatic telephone systems." Coventry Automatic Telephones, Ltd., and C. W. Wilman. November 26th, 1923. (228,660.)

30,209. "Thermionic tubes." Dr. F. Trautwein. December 4th, 1922. (207,817.)

30,974. "Electrical switches." H. W. Cox. December 10th, 1923. (228,670.)

31,166. "Receiver supports for telephone, wireless, or analogous apparatus." E. Hayward. December 11th, 1923. (228,675.)

31,977. "Multi-layer inductance coils." H. R. Taunton. December 20th, 1923. (228,839.)

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675. "Blocks for ceiling-roses and other electrical fittings." D. F. C. Mehta. January 9th, 1924. (228,690.)

1,170. "Fixed condensers for use with grid leaks in wireless apparatus." W. H. Murad. January 15th, 1924. (228,693.)

1,998. "Adjusting devices for variable electric condensers and the like." T. B. Braid. January 24th, 1924. (228,698.)

2,372. "Electric batteries." Eltax Elektro Akt. Ges., and K. Oettl. January 29th, 1924. (228,702.)

5,199. "Selectors for automatic telephone systems and the like." Siemens Bros. & Co., Ltd. (G. H. B. Bernard). February 29th, 1924. (228,720.)

5,239. "Guards for hand lamps and the like." British Thomson-Houston Co., Ltd., H. C. Wheat, and W. H. Wade. February 29th, 1924. (228,721.)

5,866. "Burglar alarms." G. B. Carpenter. March 7th, 1924. (228,730.)

6,650. "Connecting holder for thermionic valves." A. Dilger. March 15th, 1924. (228,735.)

7,213. "Variable electrical condensers." A. E. Bowyer-Lowe. March 21st, 1924. (228,737.)

8,329. "Automatic or semi-automatic telephone systems." Coventry Automatic Telephones, Ltd., and C. W. Wilman. April 2nd, 1924. (228,742.)

8,364. "Thermionic amplifiers." C. D. Tuska Co. April 2nd, 1923. (213,911.)

8,753. "Coin-freed electrically-driven mechanism." Automatic Shoe Shiner Corporation. December 10th, 1923. (226,146.)

10,602. "Telephone systems." Relay Automatic Telephone Co., Ltd., and F. M. Ward. April 22nd, 1924. (228,751.)

10,784. "Electrical switches." J. F. Monnot. May 1st, 1924. (228,755.)

11,929. "Electrically-heated ovens or chambers for roasting beans and the like." G. Glockemeier and K. Sautter. May 14th, 1923. (216,133.)

12,114. "Electric distant control system in which the receiving element is placed in a certain number of predetermined positions." E. Granat. May 18th, 1923. (216,155.)

12,206. "Electric lighting installations for motor vehicles or the like." M. A. Saran. May 22nd, 1923. (216,512.)

12,236. "Electron discharge devices." Western Electric Co., Ltd. (Western Electric Co. Inc.). May 19th, 1924. (228,760.)

12,818. "Electric regulating systems." British Thomson-Houston Co., Ltd. May 28th, 1923. (216,871.)

15,610. "Springy sockets for electric contact plugs and the like." Scharpenberg Ges. Geb. June 28th, 1923. (218,324.)

17,823. "Combination electric ignition switches." J. S. Rychlowski. July 25th, 1924. (228,787.)

17,830. "Telegraphic receiving apparatus suitable for use with printing apparatus." Creed & Co., Ltd., and F. G. Creed. November 5th, 1923. (Cognate application 16,108/24.) (Divided application on 228,610.) (228,842.)

18,103. "High-tension ignition magnets." R. Colin. August 2nd, 1923. (219,982.)

21,621. "Grid plates for accumulators." Dr. H. A. Heil. September 12th, 1923. (221,797.)

21,317. "Thermionic amplifiers used in transmitting speech or like currents of varying frequencies." Siemens & Halske Akt. Ges. September 14th, 1923. (Addition to 154,925.) (211,808.)

21,874. "Electron discharge devices." British Thomson-Houston Co., Ltd. September 18th, 1923. (222,124.)

22,180. "Primary batteries." B. Marschalko. September 19th, 1924. (228,802.)

22,714. "Electrical soldering devices." R. Fritsche. October 11th, 1923. (223,215.)

27,348. "Making electrolytic copper." M. A. Jullien. November 16th, 1923. (224,916.)

28,626. "Radiogoniometers." E. Bellini. November 24th, 1923. (225,286.)

30,460. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co., Ltd.). November 5th, 1923. (Divided application on 214,195.) (228,823.)

30,623. "Electric switches for telephone systems." H. Baron (F. Aldendorff). November 5th, 1923. (Divided application on 228,831.) (228,824.)

30,624. "Bank contact arrangements for telephone systems." H. Baron (F. Aldendorff). November 5th, 1923. (Divided application on 228,831.) (228,825.)

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175. "Duplex telegraphy." Western Electric Co., Ltd. (Western Electric Co., Inc.). August 2nd, 1923. (Divided application on 228,211.) (228,827.)

176. "Automatic switching arrangements for reversing the direction of traffic over a telegraph line or cable." Western Electric Co., Ltd. (Western Electric Co., Inc.). August 2nd, 1923. (Divided application on 228,211.) (228,828.)

Motor-car Anti-dazzle Lamps.—A massed demonstration of motor-car anti-dazzle head lamps and devices, organised by the Royal Automobile Club, took place in Richmond Park recently, being the first demonstration of its kind. During the past few years the R.A.C. has tested 30 different anti-dazzle inventions. The Ministry of Transport was represented and most of the chief constables in the country expressed a desire to be present. Members of a recent committee of the Ministry which reported on dazzle lights with a view to the introduction of legislation to solve the problem suggested that the beams of all head lamps should be restricted to a height which would bring them below the level of the eyes of approaching drivers and pedestrians. A number of lamps which produce this effect were shown, and the result proved that if the perfect anti-dazzle light has not yet been invented there are devices available that do more or less mitigate the evil.